

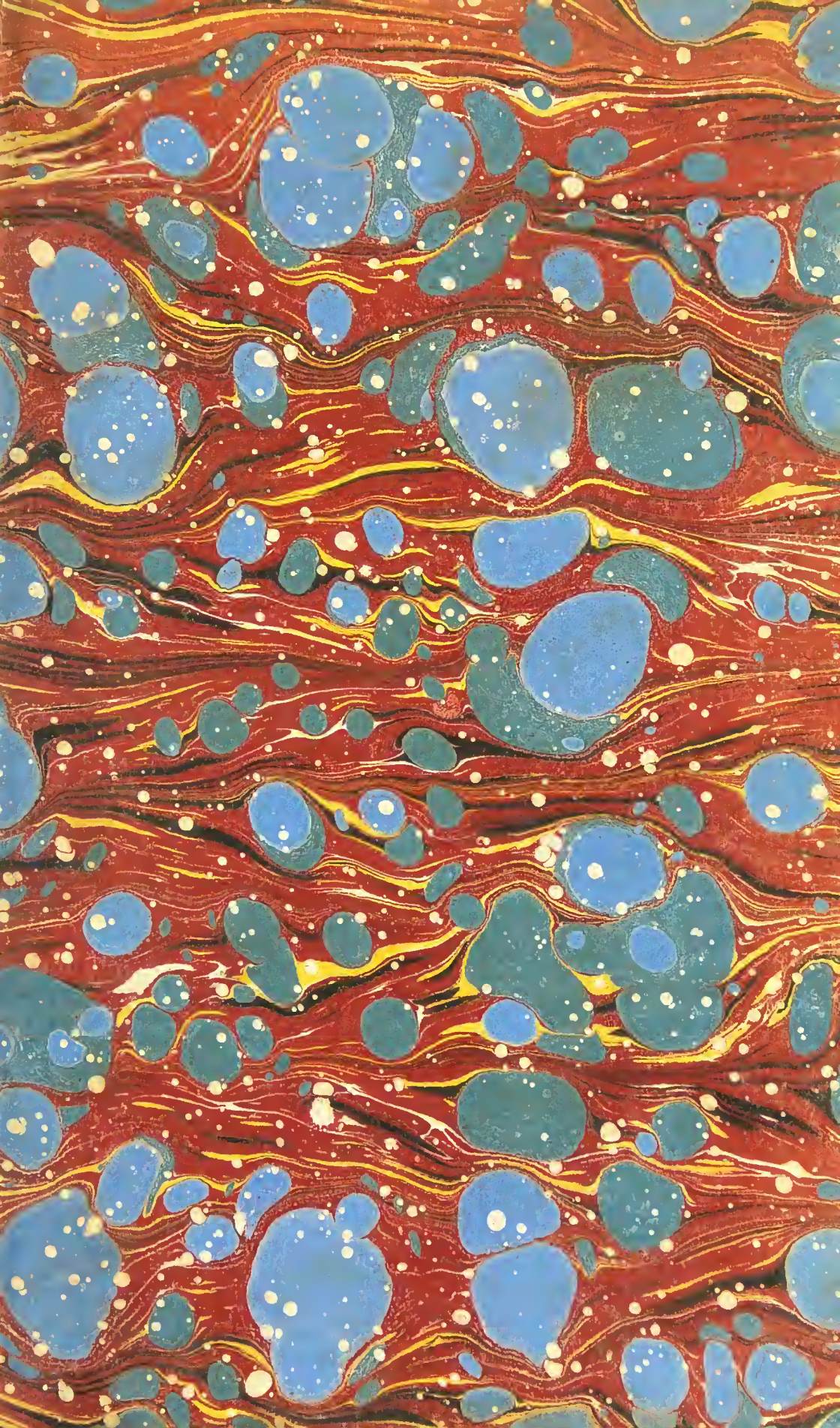
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TREATISE
ON
THE MINERAL WATER
OF
ASKERN,
INCLUDING
A DESCRIPTION OF THE VILLAGE,
HISTORY OF THE SPAW,
&c.

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“A just and adequate natural and experimental history is to be
“prepared, as the foundation of the whole thing, for we are not to
“fancy or imagine, but discover, what are the laws and operations of
“nature.”—*Novum Organum*, L. II. Aph. 10.

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PREFACE.



THE following Treatise professes objects which are almost incompatible, viz. popular utility and scientific medical information. That both these objects are imperfectly accomplished is admitted, but nevertheless the invalid and general reader may perhaps find something worthy of their attention in the first, third, and fourth chapters, and the second chapter, particularly its latter part, which is the basis of the medical directions, and from which the other parts of the work derive their origin, they may leave to the physician and chemical philosopher.

When this work was commenced, nothing more than a chemical examination of the water was thought of. The experiments to effect this were performed at diffe-

rent and distant periods, some as far back as 1810, and others as recently as 1817; for, owing to the uncertain and irregular intervals in country medical practice, it was found impossible to obtain, at any one time, sufficient leisure to perform the numerous experiments which were required to complete the investigation. Often when a series of experiments have been nearly completed, more urgent professional duties have suspended them, and from the nature of the processes, it has been necessary to recommence them before results sufficiently correct could be obtained. But from this frequent repetition of some experiments, and a determination to consider no series as perfect but what had been begun and finished at one time, the results were familiarized and the general inferences corroborated.

The method of using Askern water recommended in the following pages, differs much from what has hitherto been generally adopted, but the author does not pretend to claim any superiority of practical knowledge beyond what the medical gentlemen who have attended to the effects of the water may possess, and who may perhaps be acquainted with many valuable facts to which he is a stranger.

Perhaps many who have been benefited by the employment of the water, may think that its healing powers are not placed in a point of view sufficiently conspicuous, and that its efficacy in curing a multitude of diseases is not asserted with sufficient positiveness; but the author wishes it to be understood, that his aim is not to publish the wonders of a panacea, but to render a popular medicine more decidedly useful.

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ERRATA.

- Page 17, line 1,—*erase* sake of.
Page 28, line 13,—*for was read were.*
Page 29, line 2,—*for alumnia read alumina.*
Page 31, line 26,—*for alumnia read alumina.*
Page 32, line 17,—*for water boiled and filtered read boiled and
filtered water.*
Page 39, Note, —*for permanenty read permanently.*
Page 54, Note, —*for mur. of acid read mur. acid*
Page 59, line 22,—*for masss read mass.*
Page 62, line 5,—*for driness read dryness.*
Page 67, line 16,—*for deposits read deposite.*
Page 77, line 19,—*for drank read drunk.*
Page 91, line 14, 15,—*for all all read all.*
Page 94, line 15,—*for being read been.*
Page 129, line 16,—*for distinguish read distinguishes.*

CHAP. I.

DESCRIPTION OF ASKERN, AND HISTORY OF THE SPAW.

SECT. 1.—*Of the Village, Views, Pool, &c.*

ASKERN* is a village about seven miles north from Doncaster; its situation is picturesque and interesting, being on a rocky declivity, on the border of a plain extending to the south east. This situation is open though not bleak, owing to the elevated ground behind the houses, which in general front the plain, breaking the violence of, or sheltering from, the winds. As the village consists of farm-houses and the cottages of labourers, the accommodations for visitors were, till lately, below mediocrity. Prior to the erection of the Hotel, there was only one mean public-house, the Swan, and its principal recom-

* Askern, Askerne, Askron, or Askeron, these several ways the name has been spelt; but at the etymology of it I have not seen even a guess.

mentation was the honest bluntness of the landlord, Thomas Hackin, which overbalanced for a time the coarse rusticity and inelegance of the accommodations. Besides this, there was a boarding-house, where a good table and comfortable beds were provided, but the greater number of visitors had private lodgings in the village, almost every cottage being converted into a lodging-house.

Now (1815) the accommodations of Askern are much improved by the erection of the Hotel, which is conducted on a liberal and extensive plan, and the increasing number of visitors calls for additional accommodations.

Behind the village, the ground suddenly rises to an elevation of sixty or seventy feet above the plain, commanding an extensive view, particularly to the north east. The village, the lake and baths, and the newly-inclosed grounds of Norton occupy the foreground; in the distance, the towers and spires of several towns and villages arrest the eye, and the mansion of Lord Downe, at Cowick, forms, on a clear afternoon, an interesting object. The view is closed by the wolds of Yorkshire and Lincolnshire, as they approach on the northern and southern shores of the Humber. The prospect in other directions is less extensive, but over a richly cultivated tract of country, forming gentle undulations

of hill and dale, and embellished with numerous plantations, and gentlemen's seats. This height is remarkable for a kind of terrace on the edge of the hill, which has the appearance of having been artificially raised, but as there is no trench, and history seems to be silent concerning any military stations at this place, it is probably a natural ridge, and if so, affords scope for geological speculation. I was not able to learn whether the ridge had ever been dug into, as knowing whether the limestone (of which it is probably composed) lays in its natural courses, or in a confused heap, would at once decide whether this ridge be natural or artificial.

On the hill behind the village are the remains of a lofty conical round tower, called Askern Stand, erected by the late Bacon Frank, Esq. originally intended for a windmill, but afterwards converted into an object of view from the owner's residence.

Askern Pool is a lake occupying a surface of seven or eight acres, interposed between the village and the spaw; the water is clear and of considerable depth. The bottom consists of many feet of calcareous sand, mixed with decomposed vegetable matter; this, when disturbed, gives a temporary muddiness, which soon subsides. The water of the pool is hard,

from its abounding in calcareous matter, and in many places has the peculiar smell of sulphuretted hydrogen, showing evidently that other sulphureous springs rise at these places, and which might be inclosed, covered, and kept from contamination with rain water and the common water of the pool, if a larger supply of the mineral water were required. One of these springs rises near the margin of the pool, at the south corner, and since the draining of the low grounds is almost insulated. The pool abounds in fish, as pike, roach, dace, chub, &c. It is said that the fish which haunt the parts where the sulphureous springs rise, are remarkable for their yellow colour.

Around the pool are porous masses of stone,* bearing the impressions of leaves, and retaining the shape of moss, pieces of wood, shells, &c. In the formation of these petrifications, as they are improperly called, nature may be detected in the very act. At the end of the pool, near the dam, some of the smaller aquatic plants are sometimes found incrustated with stony matter, the plant still vegetating, even when the principal stem is surrounded by a stony rind; and in some of the recently formed masses are inclosed species† of fresh water shell

* Testaceous Tufa of Kirwan.

† Species of Planorbis and Lymnaea.

fish, still living. These incrustations, or apparent petrifications, originate from the water; which during its course between the strata or chinks of the lime-stone rocks of the high land, becomes charged with calcareous matter to the point of saturation, and hence, on slight evaporation, or an increase of temperature, a deposition* of it takes place, which soon hardens, retaining the impression of, any compact substance on which it may be deposited, or if the substance be porous the calcareous matter occupies the pores. For instance, when a piece of wood appears to be converted into stone, sometimes the woody fibres still remain, but with stony matter insinuated amongst them; but in other cases the fibres decay and are washed out, leaving a mass wholly of stone, fibrous, porous, and of an internal structure resembling the original wood; though it is evident, in such transmutations, that the present fibres must be casts of the pores, and consequently occupy the situation and be in proportion to the number of longitudinal pores in the prototype. Similar depositions occur in many other places where water traverses

* The water of the pool contains carbonate of lime held in solution by carbonic acid, and some sulphate of lime; and that the incrustations are not formed of the carbonate only, is evident by their solubility in muriatic acid not being complete, and the solution giving a white precipitate, with muriate of baryta.

lime-stone, particularly at Scarthing Moor, Matlock, and Knaresborough.

From this short account, it is evident that Askern cannot rank among watering places whither the fashionable and the gay resort for mere pleasure; yet this very circumstance makes it preferable to many other places, where it too often happens that the good effects of the waters are more than counteracted by the luxury of the table, and the corrupt atmosphere of the ball-room; yet amusements are not wanting, morning walks and rides, afternoon saunters, fishing parties on the pool, &c. afford sufficient modes of enjoying the refreshing breeze.

The walks about Askern present considerable variety, and some of them, with a slight assistance from art, would become eminently conspicuous in rural beauty. But though wholesome air, pleasant walks, and comfortable roads are indispensable at a place resorted to for the purpose of regaining lost health, yet it is not enough that the walks be merely pleasant and air wholesome; something more is required to tempt those of a sedentary habit to take exercise.

The novelty of a place will tempt even the most indolent to exert themselves in viewing it, but when this wears off something is required to rouse them from their habitual

inactivity, and prompt them to exertion. Agreeable companions will tempt some from the window and fireside to enjoy the refreshing walk, others the beauties of nature alone will persuade, and to some minds present a never-failing source of amusement. They, whom the beauties of nature delight, may here find much to admire, Flora having distributed her gifts with a liberal hand; and if contemplating the mineral kingdom gives pleasure to their minds, even still they may discover enough to amuse.* To relish such pleasures as these it does not require a person to be a naturalist, neither is it necessary that an invalid should study—to admire is amusement sufficient; and though a taste for admiring works of nature is not common to all minds, yet there are but few, perhaps none but the most sensual, that may not acquire this rational power of deriving amusement from so extended a source.

Since botany is becoming a fashionable amusement, particularly amongst well educated females, many will be interested in learning that Askern seems to be one of the few places in England where most of our indigenous plants flourish, within a very small circuit: for from the high ground being calcareous, the low somewhat peaty, the line of

* A short sketch of the geology of Askern and the adjacent country is given in the first section of the next chapter.

junction a rocky acclivity, and a lake of fresh water contiguous, the plants peculiar to these different situations may here be expected, and we need not hesitate in concluding, that perhaps all the plants indigenous to Yorkshire, Nottinghamshire, and Lincolnshire, except alpine and maritime plants, here flourish. Even persons unaccustomed to botanical investigation will here observe plants that have not before caught their attention, particularly Deadly Nightshade (*Atropa Belladonna*) which is very conspicuous, and ought to be mentioned as a caution against the deleterious effects resulting from swallowing its fruit. It grows from the crevices of the rocks, and in autumn displays its luscious purple berries, as it were to allure the incautious passenger to pluck and eat. Nearly allied to the vegetable kingdom, is a singular substance found in a pond at the south corner of the pool, adjoining the high road. This substance is a powder of a pink or rose colour, which forms a thin covering on the sand and mud at the bottom of the pond. What its real nature may be is at present doubtful. From its laying on the surface of the mud, it appears to be specifically lighter; and this is corroborated by its remaining suspended longer than the mud, when the water is agitated. At first it struck me, that it might be a powdery Lichen, but as no

Lichen is described by botanists of such a colour, and vegetating in such a situation, this supposition is most likely unfounded. In attempting to discover whether it originated or not from the anthers or seed vessels of any of the aquatic plants, no satisfactory information was obtained. It may be a precipitation or lake from some vegetable matter, by the agency of a sulphureous spring that is almost contiguous, and mixes its water with that of the pond; and from the fine colour of this powder, its similarity to the lake used as a pigment is very striking.

SECT 2.—*Historical Account of the Spaw.*

In search of health, the three kingdoms of nature have been ransacked; and so anxious has the valetudinarian been to obtain this inestimable blessing, that with impatient credulity he has often been more ready to swallow the pretended specifics of the illiterate quack, or listen to the unintelligible jargon of occult philosophy, than to attend to the sober voice of reason. A desire of knowledge, avarice, or necessity, has prompted many to join him in this search, and their labours have discovered

medicines innumerable, some inert, others powerful; many of each class have been handed down from the earliest ages to the present day, composing a catalogue of remedies so formidable that one cannot contemplate it without being surprised that mankind should still be tormented with pain and sickness.

To the ancient physicians or natural philosophers, and the superstitious vulgar, we are to look for the origin of most of the remedies with which medical books have abounded. Certain plants and minerals have some striking marks* or forms, which by some of the ancient physicians were supposed to resemble such parts of the human body as when diseased they would prove effectual in healing; thus the flower now known by the name of Eye-bright, (*Euphrasia officinalis*) was supposed to bear a resemblance to the eye, and consequently (to use the language of this school) was *sealed*, and therefore must be wonderfully useful in curing diseases of that organ. In the like manner, because the plant Lung-wort (*pulmonaria officinalis*) has spotted leaves bearing a fancied resemblance to the surface of the lungs, it was considered as good in pulmonary complaints; and celandine, (*Chelidonium† majus*)

* Tractatus Oswaldi Crollii de Signaturis Internis Rerum, &c. Genevæ, 1643.

† This plant abounds with yellow juice.

crocus or saffron, the middle yellow bark of the elder, tumeric, &c. were considered as eminently useful in jaundice. Among minerals, an ore of iron* of a red colour, and form somewhat resembling clotted blood, was used for stopping the flow of blood from wounded vessels; from similar motives, and for a like purpose, was red coral† introduced into medicine. On principles somewhat similar, certain parts of particular animals were accounted useful in the cure of diseases; thus the hearts of partridges were accounted excellent for affections of the heart, the brain of the hog for mental affections, and yellow wood-lice, and concretions found in the gall bladder of the ox, for jaundice and other bilious complaints.

Though many substances used as medicines might thus be the offsprings of fanciful hypotheses, yet perhaps an equal or greater number might be introduced in a manner more consonant with reason.

It is natural to suppose, that substances possessed of a strong taste, of a powerful odour, or of a nature so acrid as to destroy the skin

* Red Hæmatites of mineralogists.

† Coral, now known to be an animal excretion, was then considered to be a mineral substance. Neither this nor the Hæmatites were directed to be applied to the bleeding vessels, but to be held in the patient's hand till the cure was effected.

when applied to it, might produce good effects in diseased states of the body, if used properly; hence, a sick person despairing of recovery might be induced to try such substances, and if he recovered, no matter whether the substance used effected the cure or not, it would be ranked among medicines and resorted to by others in similar complaints. In this manner, it is probable that musk, camphor, euphorbium, and also many of, or all, the mineral waters remarkable for some obvious external properties, were first introduced into medicine; and by subsequent trials their proper rank among medicines would ultimately become established. The mineral water which is the subject of our immediate consideration, presents a strong and peculiar odour as its most obvious characteristic, and this undoubtedly first attracted notice, though from observing the medicinal effects it produced on cattle seems to have led to a trial of it on the human subject.

At present, it seems impossible to ascertain when the Askern Spaw was first discovered. From oral information, we learn that it has been used for upwards of a century, in curing eruptions both in men and cattle.

In 1771, the celebrated naturalist Thomas Pennant, in his *Tour*, informs us that "Askeron" was celebrated for a sulphureous

spring, the medicinal qualities of which were discovered by the farmers, who drove their diseased cattle into the pool, which is within a few yards of it, and thus removed their maladies.

Dr. Short, in his History of the Mineral Waters of Yorkshire, &c. printed in 1734, mentions this water, and from his manner of noticing it, it seems then to have been of long standing, and of well-attested efficacy, or otherwise one would scarcely have expected that, at so obscure a village, a “fine stone bason” would have been dedicated for the reception of the water.

His account, after speaking of a former sulphur water, is as follows:—“We meet with
 “one of much greater note at *Askeron*, five
 “miles from *Doncaster*, in *Campsel* parish;
 “seven miles from *Pontefract*. It is exceeding
 “clear water: it has a fine Stone Bason, and is
 “inclosed by a round Walk. It’s stream is full
 “of white thick Sludge, which ropes like a decoction of *Althæa*. It smells and tastes very
 “strong of *Sulphur*: it crudles Soap and Milk;
 “turns Silver black,—Brass a blue copper
 “colour. It retained its *sulphur* smell to a third
 “degree of Heat. It becomes muddy, and
 “crudles in boiling. It is a very diuretic light
 “Water. The Farmers find it of notable service
 “to them in curing chaffed Feet, Saddle galling;

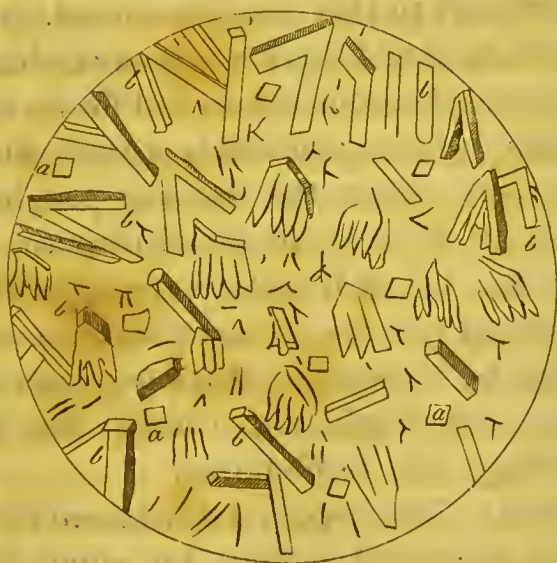
“Horses or Oxen galled in the Yoke, or by
 “Loading, &c. mangy Dogs, scabb’d Horses,
 “&c. It has done some notable Cures in in-
 “veterate strumous and’ other Ulcers, Scab,
 “Leprosy, &c. It’s muddy white, with Solution
 “of Silver ; a clear sky Blue, with Tincture of
 “Verdigrease ; light Yellow, with Tincture of
 “Rhubarb : It’s first white then crudles, and
 “lets fall a large brownish sediment with Sugar
 “of Lead ; with Oil of Tartar and Spirit of
 “Hartshorn, it is whitish, crudles, and lets fall
 “much sediment. It makes a strong Ebulli-
 “tion with the acid Spirits ; with Tincture of
 “Logwood a beautiful deep Red ; with Tincture
 “of Galls a muddy White. Five Quarts of it
 “exhal’d, left three Drams of white sparkling
 “sediment, a Dram whereof was a fine Salt,
 “which crackled on a hot Iron ; turned Syrup
 “of Violets green ; fermented little with the
 “acid Spirits, but struck the Nose with a pun-
 “gent smell. The rest of the Salt dissolved
 “and set to crystallize, projected very fine
 “Crystals of Nitre and Marine Salt ; the last
 “was the largest. The sediment here is to the
 “Water, as 1 to $426\frac{2}{3}$; the Earth to the Salt
 “as 2 to 1.

“This *Spaw* is within a few Yards of *Askeron*
 “Pool side, the Water whereof is very hard,
 “crudles Soap into hard Flakes, yet bleaches
 “exceeding fine, stinks in Summer, abounds

“with Pike, Perch, &c. It has several pro-
 “found Pits in it, the Depth whereof are not
 “known. It is constantly supplied with Water
 “from these Pits; never is less in the greatest
 “Drought, nor overflows in the greatest Rain,
 “except the Mill-Dam below is stopt up with
 “Sludge and Grass. The Soil on one side is all
 “Lime-stone; on the other side a white Clay,
 “half a Foot deep; and below that a very fine
 “white Sand.”

*Crystals of the Salt of Askeron Spaw.**

a a a Marine Salt.—*b b b* Nitre.



* The engraving, with the preceding quotation, constitutes the whole of Dr. Short's History relative to Askeron; and although, from the more perfect state of chemical science, such graphic representations have become useless, yet they may rank among literary curiosities.

As far as I know, these are the first original writers that have mentioned Askern, as connected with its mineral water; but long before this, traditionary information shews that from places six or eight miles round, Askern was frequented by persons affected with various complaints, particularly such as pain and stiffness of the joints, and eruptions on the skin. About 1760, the stone bason seems to have gone to decay, the well having become an irregular puddle, uninclosed, and often contaminated by the washing of mangy dogs and pigs. And as marking the character of the times and state of manners in this neighbourhood, it is worth recording that Askern was then celebrated both for its sulphureous water, and for its *Wise Man*, Joshua Ivison, commonly called the *Askern Witch*, to whom the country people used to apply to have their nativities cast, fortunes told, &c. till at length the peace of the neighbourhood appears to have been so much disturbed by Iveson's predictions, that the magistrates interfered, and caused his books of astrology, &c. to be burnt.

About 1786, a rude establishment for bathing was commenced behind the stone bason, or rather more distant from the pool, and this scite now retains the name of the Old Bath, as the well was become, as stated above, an irregular puddle. Soon after this, the well was

defended from the rain, for the sake of accommodation of visitors, by a straw shed, in which state it remained till about 1794, when the sides of the well were defended by masonry, and a neat stone building erected by the Lords of the Manor.*

The celebrity of Askern now began to be more widely diffused, and two wells were used for the purpose of drinking and bathing, the one on the scite of, what was before mentioned as, the old bath, the other taking the water from the inclosed bason.

In this state was the Askern spring when the experiments in the succeeding chapter, to investigate its composition, were commenced. In speaking of the two wells, in the following pages, I shall, to avoid ambiguity, call the one nearer to the pool the *Manor-Well*, and the other the *Old Bath*. Both are now furnished with bathing and dressing rooms, and those attached to the Manor-Well are built on a regular architectural plan, and as viewed from the village afford a pleasing and elegant object.

* Viscount Galway and Humphry Osbaldeston, Esq. are joint Lords of the Manor of Askern.

CHAP. II.

PHYSICAL AND CHEMICAL HISTORY

OF

ASKERN MINERAL WATER.

PART I.

THE PHYSICAL HISTORY.

SECT. 1.—*Situation and Source of the Spring.*

THERE is a district in the south of the county of York where lime-stone is the prevailing rock. This district is bounded on the north by the vale of York; it stretches south into Nottinghamshire and Derbyshire; on the west it is bounded by the coal district, as at Barnsley and Rotherham; on the east it is bounded by friable sand-stone, provincially called *sand-rock*, and gravel, as at Doncaster and the Levels about Thorne, &c. but owing to the alluvial deposition and peat which covers some of the flat country, the friable sand-stone is not so easily traced. The general dip of this lime-stone is towards the east, but its inclination is

not great. Its geological situation, as connected with other rocks, is—that its bed seems to be parallel, or conformable with the rocks of the coal district, and it reposes on the argillaceous sand-stone, (which constitutes so prevailing a rock about Rotherham and other places on the eastern limits of the coal district) and seems to dip under the friable sand-stone. The lime-stone varies in aspect at different places, but in general it is harder, more granular in its texture, in thicker strata, and capable of being quarried in larger blocks, as it approaches its western boundary; and towards its eastern boundary is softer, more earthy, and its strata so thin as almost to become slaty. These appearances, as connected with its chemical composition, appear to be, that (though, I think, it all contains carbonate of magnesia, as well as carbonate of lime,) in the harder and more granular varieties the principles are in more strict chemical union, so as to resemble Dolomite;* but in the softer and more earthy varieties the principles are mechanically mixed, rather than chemically combined, and along with the earthy carbonates there is present a considerable proportion of alumina, hence it often approaches to the state of marl, and sometimes

* A mineral which was first particularly noticed by Dolomieu, and contains carbonate of lime and carbonate of magnesia.

the transition is complete. The former of these varieties may be called *granular magnesian lime-stone*, the latter, *earthy magnesian lime-stone*. The granular variety is quarried at Roach Abby, Conisbrough, &c. and at the former of these places is white, and composed of distinct angular-granular concretions, and from its fine colour and beautiful texture is used extensively in ornamental architecture. The earthy variety is quarried at Tickhill, Balby, Askern, and Knottingley, all which places are on the very verge of the eastern boundary. It is much used in agriculture, particularly that quarried at Knottingley.

Imbedded in the lime-stone is a bed of clay and gypsum, but it is only of partial extent, and seems interposed between some of the strata of the earthy variety. This bed exists at Brotherton, Wadworth, and Askern, though in quarrying the lime-stone at these places they do not usually work deep enough to penetrate it. At Brotherton it is worked into, in making tunnels and inclined plains to convey the stone from the quarry to the river. At Wadworth, about four miles from Doncaster, it is sometimes penetrated in sinking wells, and in one instance afforded a water impregnated with sulphuretted hydrogen, which still remains in a close near the foot road between Wadworth and Rossington. At Askern it was

penetrated in sinking a well at a farm-house, in 1815, and fine specimens of fibrous gypsum* were raised, and also in sinking a well at the manor-house, in 1816. In sinking this well were penetrated about seven yards of lime-stone, then about ten yards of red clay and fibrous gypsum, alternating with each other in thin beds, the beds of gypsum varying from one to five inches; to these succeeded a bed of white small-foliated gypsum, coated with blue clay, and on perforating this bed, water rushed through the opening with great impetuosity. Some fine specimens of brown massive selenite were found during the progress of the work.

Askern is situated at the eastern boundary of the above lime-stone district. The village is built on the earthy magnesian lime-stone rock.

The pool is at the foot of the lime-stone hill, on the level plain which here commences. The bason of the pool, under which it is probable the lime-stone strata dip, is formed of alluvial matter, as also is the plain around. Near to the lime-stone hill the soil of the plain is principally calcareous sand, with some loam, and more distant is silicious sand. Below the calcareous sand, silicious sand is also found, as may be seen where the recently formed drains

* Provincially called *Hen-chalk* or *Plaster-stone*.

are dug. Around the pool, and amongst the calcareous sand, irregular porous masses of testaceous tufa* are interspersed, and near to the margin of the pool the quantity of this stone is so considerable as to form an almost continuous bed at the depth of about three feet from the surface, through which the mineral water rises.

From the inclination of the strata of the lime-stone rock, and from the situation of clay and gypsum imbedded in it, it is probable that some fissure through the strata which dip under the pool, may afford a passage for the mineral water to rise from the bed of clay and gypsum to the surface, and hence give origin both to the springs of sulphureous water which are known to exist in the pool, and also to the particular one which is used for medicinal purposes. There can be no doubt but that all the springs, both of common water and sulphureous water, which occur at Askern, are derived from water which descends along the natural courses or strata of the rock. Two springs of common water may be seen issuing from among the rocky strata, and running into the pool, and these two springs, and all the wells that are used for household purposes, afford water of the same nature, viz. very hard,

* Vide page 4.

partly from the sulphate of lime it contains, and partly from lime-stone held in solution by carbonic acid gas, and this gas being evaporated when the water is boiled, the lime-stone is deposited at the bottom of the vessel, and forms that stony substance which is so much complained of as incrusting the tea kettles and boilers, and also gives rise to what is sometimes here viewed with astonishment—that clear spring water should by boiling become muddy.

The sulphureous water is what probably runs from a distance along the clay and gypsum bed, and then rises through some fissures, and the probability of this is increased by the instance of a weak sulphureous water being obtained from this very source at Wadworth, as before mentioned. We may suppose that one portion of the water which falls from the atmosphere on the lime-stone penetrates to the clay and gypsum bed, and as water does not readily penetrate a bed of clay, remains in contact with it, running along the natural inclined plane of the bed; and that another portion of the water does not sink so deep; and the one rises in the state of sulphureous water, the other in the state of mere hard water. The fissures through which the sulphureous water rises may be those natural and almost vertical rents, which are observable

in the lime-stone quarries to go quite through all the strata, and the common water may rise through any partial disarrangement or breaks in the strata. That the mineral water may derive its origin from this supposed source will be strengthened when its composition is considered, yet it must be owned our present chemical knowledge will not satisfactorily explain in what manner the water obtains its sulphuretted hydrogen, though its elements exist in gypsum and water, but its not being explicable, is no argument against its being possible. Perhaps some substances may occur in the course of the water, which assist in destroying the balance of affinities among the elements of the gypsum, and this circumstance may be only of partial occurrence, or may require a great length of time, otherwise one would expect to find that all water rising from a bed of clay and gypsum would be sulphureous, which is not the case.

SECT. 2.—*General Qualities and physical Characters of the Water.*

The water issues through testaceous tufa, as mentioned in the preceding section, no air bubbles are observable, but the presence of sulphuretted hydrogen gas is announced by its peculiar smell.

The SMELL resembles the rincings of a gun barrel or putrid eggs.* The mineral water is said not to be increased by rain, but as the bason, particularly of the Manor-Well, runs over when it rises to a certain height, it is difficult to know how far rain may or may not affect it, and from the same cause it is difficult to ascertain the quantity of water which the spring affords, but an approximation may be obtained thus:—Thirty individuals are said to have bathed at the Manor-Well in a day, and each has required about 45 gallons, hence this well alone must afford upwards of 1350 gallons daily.

The FEEL of the water, on rubbing it between the hands, is meagre or hard.

The COLOUR of the water, as viewed in the well, is a bluish black, but this is in a great measure owing to the colour reflected from the sides and bottom of the well, where some blackish mud is deposited. When it is fresh taken from the well, and viewed by looking down into a glass of it placed on white paper, it appears bluish; and on looking horizontally through it, and comparing it with the common spring water, a slight degree of milkiness is perceptible.

* The observations and experiments apply to both the Manor-Well and Old Bath, if differences occur they will be noticed in the course of the investigation.

A MILKINESS takes place in the water on standing about an hour, and a white film is perceptible on the surface. On standing a day or two, a grey powder attaches itself to the sides of the glass, and the glass round the surface of the water becomes stained with an indelible bluish mark. These effects are more distinctly seen in the Water from the Manor-Well than in that from the Old Bath.

The TASTE of the water is sulphureous and slightly saline, and leaves an earthy and somewhat meagre impression on the tongue.

The TEMPERATURE of the water is not constantly the same, but as it is said never to freeze, its temperature must always exceed 32° . The temperature was tried with accurate thermometers, the bulbs being wrapped with tow, as recommended by Bergman, to prevent evaporation and consequently a too low temperature being indicated by the thermometer on its being withdrawn from the water. The following results were obtained :

	<i>Manor-Well.</i>	<i>Old Bath.</i>	<i>Town's Well of Common Water.</i>	<i>Air in the shade.</i>
1810.				
April 25,	At bottom about 3 ft. deep $42^{\circ}\frac{1}{2}$ At pump $43\frac{1}{2}$	..... $42^{\circ}\frac{1}{2}$ $43\frac{1}{2}$	Not tried Not tried	56°
26,	As yesterday	As yesterday	At bottom } 4 yds deep } 43°	49
1811.				
Sept. 13,	At bottom 62	..... 62		$70\frac{1}{4}$

From these trials it appears that the temperature of both the mineral and common well water falls short of the temperature of the air, and this is probably the case always between the spring and autumnal equinoxes, while on the contrary during the autumnal and winter quarter, they probably exceed the temperature of the air in an equal proportion, and like the generality of wells in the neighbourhood, their lowest temperature may be about 40° , and their highest about 62° .

The SPECIFIC GRAVITY of the water is, as obtained by repeatedly weighing a portion from the Manor-Well and an equal volume of distilled water, 1.0019, distilled water being 1.

The parts of the building about the well that are painted white, as also glass vessels in which the water long remains, become of a leaden colour, from the sulphuretted hydrogen gas acting upon the lead, which enters into the composition of the glass and the paint, and from the same agency silver in the pockets of the attendants acquires a brown tarnish, and the same is acquired almost instantly on putting a piece of silver into the well.

At the bottom and sides of the well is a slight coating of a bluish black colour, but it is too closely attached to the stone to be collected pure. Also at the bottom of the iron

boilers used for heating the water, there is formed a deposit of considerable thickness.*

PART II.

THE ANALYSIS.

SECT 1.—*General Application of Tests.*

The tests employed throughout the analysis, were added to about two ounces of the water, and a similar quantity of distilled water was also treated in precisely the same manner as the mineral water, so that any inaccuracy arising from any impurity in the preparation of the tests, particularly when more than one reagent was required to the same portion of water, might be immediately detected.

All solutions of salts used as tests were in the proportion of 1 of the salt to 9 of distilled water, unless the insolubility of the salt disallowed of this proportion.

The water employed was fresh, and of course contained its volatile ingredients, unless it is mentioned to the contrary.

Experiment 1. Lime-water produced milkiness, but with boiled water no change. From which the presence of *carbonic acid gas* may be inferred, and the absence of uncombined

* Vide Sect. 4 of this chapter.

sulphuric acid, and of the sulphates of magnesia and alumina, may also be inferred, or existing only in very minute proportion.

2. Infusion of Litmus was slightly reddened, but with the boiled water was unchanged. This indicates the presence of a volatile acid, and with Experiment 1 corroborates the presence of *carbonic acid*, though probably sulphuretted hydrogen gas might assist in producing this effect.

3. Acetate of Lead produced a brown colour with water from the Manor-Well, and a greyish brown precipitate afterwards settled. With the Old Bath water the brown colour was very slight.

4. Nitrate of Silver immediately produced a brownish colour, and a greyish brown precipitate settled. With the Old Bath water the tinge of brown colour was very dilute, and the precipitate nearly white. Acetate of Lead and Nitrate of Silver individually threw down a white precipitate, from the boiled water, but no discolouration took place; from 3 and 4 the presence of *sulphuretted hydrogen* is positively attested, and was evident also in the former section, from the smell, the discolouration of glass vessels, and the tarnishing of silver coin. The precipitate from Experiment 3 corroborates the presence of carbonic acid gas, and probably of sulphuric acid and muriatic

acid, and 4 indicates the probable presence of *muratic acid* or *sulphuric acid*, or both, but they must be in combination, as Experiment 2 showed the absence of all uncombined fixed acids.

5. Turmeric paper and Tincture of Turmeric were unchanged both with the boiled and recent water; a proof that there is no uncombined alkali, or alkaline earth, which indeed could not be expected from Experiment 2, but it also is a proof that no alkaline carbonate is present, and also that the sulphuretted hydrogen is simply united to the water, not combined with an alkali, forming an hydro-sulphuret, or in the language of Kirwan, an hepatule.

6. Tincture of Galls produced no change.

7. Prussiate of Pot-ash, no change except a slight milkiness. This and the former experiment indicate the absence of iron, nor could its presence be expected, as metals in general are incompatible with sulphuretted hydrogen.

8. Sulphate of Iron produced an instant blackening of the water, and a black precipitate afterwards deposited. This corroborates the presence of *sulphuretted hydrogen*.

9. Oxalic Acid produced an instant copious white precipitate. A precipitate was also thrown down after adding ammonia and filtering. After boiling, the water gave a white

precipitate, but not so quickly. This, on the whole, shews the presence of *lime*, though perhaps the precipitate prior to the addition of ammonia might be owing to other earthy salts, but the precipitate after boiling shews that if lime be present in the water it must exist both in the state of *carbonate* and also united to a *fixed mineral acid*.

10. Ammonia produced an instant white cloud and precipitate, partially soluble in muriatic acid; with boiled water a flocculent precipitate in small quantity was produced, but not immediately.

11. Ammonia was used after expelling the carbonic acid with an excess of muriatic acid, lest the ammonia taking the carbonic acid which might hold the carbonate of lime in solution, might occasion a precipitation of that earth; and after these precautions were used, a cloudy whiteness was produced. From 10 and 11 it appears that *magnesia* or *alumina*, or both, may be present, and from 11 it may be presumed, that though they may be combined with carbonic acid, yet they may also be combined with a fixed acid.

Succinate of ammonia precipitates alumina from its combinations with other acids, as discovered by Dr. Marcet, in his analysis of the Chalybeate Spring, near Brighton.* Dr.

* Saunders on Mineral Waters, page 386.

Marcet does not mention its action with salts of lime, but as I found succinate of ammonia give a precipitate with lime water and with nitrate of lime, it cannot be used as a discriminating test of alumina, till the salts of lime are separated by oxalate of ammonia.

12. Succinate of ammonia added to the fresh water, and the precipitate separated by the filter, and then ammonia added—no precipitate ensued, but a slight milkiness, hence *magnesia* is indicated.

13. Succinate of ammonia added to Askern water, which had previously been boiled, and treated with oxalate of ammonia, and filtered, gave no precipitate, hence *no alumina* except carbonate, as indicated by Experiment 11.

14. Ammonia, added to the water boiled and filtered, gave a milkiness, and a white precipitate succeeded, hence *magnesia* combined to a fixed mineral acid is indicated.

15. Baryta water, added to the boiled water, produced a white precipitate.

16. Muriate of Baryta produced an instant white precipitate. This and Experiment 15 indicate the presence of *sulphuric acid*, and as no uncombined fixed acid exists in the water (1) the presence of a *sulphate* is evinced.

17. Nitrate of lime added to the water, which had been previously treated with lime water, then concentrated and oxalic acid and alcohol added, to get quit of all earthy sulphates and

lime,* gave no immediate precipitate, but in a few minutes a very minute quantity of a white granular precipitate. This indicates the presence of an *alkaline sulphate*.

18. Nitrate of Silver, added to the boiled water, produced an instant dense white cloud, and a precipitate subsided, insoluble in nitric acid. Prior to the testing with nitrate of silver, the sulphuric acid was separated by nitrate of baryta. From this a *muriate* is detected, as uncombined muriatic acid cannot exist, as was proved by Experiment 2, &c.

19. Nitrate of Silver, added to the water previously treated with nitrate of lead that all the muriatic and sulphuric acid might be separated, gave a white cloud,† but on comparing it with the cloud given by a weak solution of muriatic acid, a shade of brown could be perceived, hence probably *some extractive* matter may be present in the water.

20. Acetate of Silver added to the water, which had been previously boiled, and cleared of sulphates by the application of alcohol and nitrate of baryta, gave an immediate

* This method of assaying for sulphated soda and potash is employed by Kirwan, but does not the oxalic acid, if the least remains suspended, act on some of the nitrate of lime, and render this method exceptionable?

† Though this experiment was repeated several times, yet the results were the same. The nitrate of lead seemed incapable of entirely throwing down the acids intended.

precipitate, indicating the presence of an *alkaline muriate*.

Before collecting the inferences from the above application of tests, it is worth while to review the application of tests as employed by Dr. Short, upwards of eighty years ago.

<i>Test used by Dr. Short. Asken Water.</i>	<i>Results he obtained prior to 1784.</i>	<i>Results from 1816, that differ from the former column.</i>
With Soap, Milk, Solution of Silver, Tincture of Verdigrise, Tincture of Rhubarb, Sugar of Lead,	crudles. crudles. becomes a muddy white. a clear sky blue, a light yellow. first white, then crudles, and lets fall a large brownish sediment.	affords a brown precipitate.
Oil of Tartar and Spirit of Hartshorn, } Acid Spirits, Tincture of Logwood,	whitish, crudles, and lets fall much sediment. makes a strong ebullition. becomes beautiful deep red	no ebullition. deepened with a tinge of violet.
Tincture of Galls,	a muddy white.	

The results obtained by Dr. Short are on the whole the same as obtained in the repetition. The effects of solution of silver, and of sugar of lead, are similar to Experiment 3, and 4, making due allowance for difference of expression and the advancement of the technical language of chemistry; the effects of oil of tartar and spirit of hartshorn may be referred to Experiment 11, and the effects of tincture of logwood agree as nearly as can be expected. Had not Dr. S. mentioned *a beautiful red*, perhaps one might not have noticed the colour so minutely as to observe the violet tinge. But the effects of tincture of verdigrease and of the acid spirits differ very much from the results which they now give. The effects produced by the mixture of any sulphureous water with tincture of verdigrease are invariably the production of a brown or black colour and precipitate, hence some error may have occurred in the recording of the experiments, as Dr. Short, from the many waters on which he had experimented, must have noticed this general effect. It is probable that the colour mentioned is that of the liquor after the precipitate has subsided. The ebullition with the acid spirits might be owing to the water being turbid, by some of the calcareous matter from the bottom being stirred up when it was

taken from the well. It cannot be supposed that the nature of the water is^r altered since Dr. Short wrote, for his experiments with solution of silver and sugar of lead prove the existence of the very ingredients that would precipitate from tincture of verdigrease a brown sediment. The ebullition with acid spirits could only be owing to alkaline or earthly carbonates, and the presence of the former would give to tincture of rhubarb a red colour, but his experiment shows that this is not the case, and the presence of the latter must be in much greater proportion than two drams* to five quarts of water, (the quantity of earthy matter obtained by Dr. S.) or no ebullition would occur from adding an acid to the water. Though these discrepancies appear in Dr. Short's experiments, yet it is but just to acknowledge, that according to the state of chemical science in this country when he wrote, his experiments were conducted with considerable skill, that his researches were extremely laborious, and *that he^s investigated the properties of more mineral waters than any person either before or since.*

From the application of the tests (1 to 20)
may be inferred

the presence of

and the absence of

Carbonic acid, (from
Exp. 1 and 2.)

Alumina except car-
bonated, (13.)

Sulphuretted hydrogen,
(3, 4, and 8.)

Sulphuric acid combined,
(15 and 16.)

Alkaline sulphates, (17.)

Muriatic acid combined, (4.)

Alkaline muriates, (20.)

Carbonate of lime, (9.)

Lime in combination with
sulphuric or muriatic
acid, (9.)

Carbonate of alumina, (13.)

Magnesia with a fixed acid,
(14.)

Extractive matter, (19.)

Of the above salts indicated by tests some
are incompatible with each other in a state of
solution.

Earthy muriates *are incompatible with* alka-
line sulphates, therefore one or other of these
must not be expected.

And also from our knowledge of incom-
patible salts we have the general results of the
tests confirmed. Thus if the sulphuric acid

be combined with lime, there can be *no* carbonate of magnesia ;—if carbonic acid be combined with lime, there can be *no* alum or sulphate of alumina ;—and if muriatic acid be combined with lime, there can be *no* sulphate of magnesia. And therefore we may expect to find the water contain sulphate of lime ; sulphate of magnesia, unless muriate of lime in considerable proportion be present ; muriate of lime and muriate of magnesia, or one of them, unless alkaline sulphates in a notable quantity be present ; muriate of an alkali : carbonate of lime ; carbonate of alumina ; and also vegetable extractive matter, carbonic acid gas, and sulphuretted hydrogen gas.

SECT. 2.—*Of the Analysis. Estimation of the gaseous Ingredients.*

The water in a given quantity was boiled in a retort of known capacity, and the beak immersed in a quicksilver pneumatic trough under a jar filled with mercury. This process was repeated several times with retorts of different capacities, and with from $3\frac{1}{4}$ ounces to 16 ounces of water, but the results of the different experiments were too discordant to admit of any precise inference. This discordance might

perhaps be owing to want of manual dexterity in performing the experiments. But supposing the experiments to be performed with all possible accuracy, the sulphuretted hydrogen must be obtained in less proportion than it exists in the water, owing to its combining with the quicksilver; and it must also be obtained in varying proportions, the proportions depending on the surface of the mercury presented, and the celerity with which the gas is disengaged. An error must also arise from the aqueous vapour passing over along with the gas, and forming a stratum on the surface of the quicksilver, and reabsorbing part of the gas, thus reducing the quicksilver apparatus to the nature of a water apparatus. Not being able to obtain satisfactory results from this mode of operating, the apparatus invented by Dr. Garnett,* in consequence of his meeting with similar difficulties, was resorted to, viz. a cylindrical vessel or bottle of tin, with a narrow neck, containing three pints, the neck protruding through the bottom of a tin bason soldered around it. In using this contrivance the bottle is filled with the water to be analysed, the bason is filled to the height of about two inches with common water, and

* Observations on the methods used for obtaining the different permanently elastic fluids from mineral waters.—London Medical Journal, vol. 1, page 233.

a graduated phial, divided into cubic inches and tenths, is filled with distilled water, heated to about 100 degrees, and inverted over the neck of the tin bottle. The apparatus is then placed upon a slow fire, till the water boils gently. All the elastic fluids contained in the water will be expelled by the heat, and rise through the neck of the tin vessel into the graduated phial, displacing the distilled water which it contains, and when no more gas rises, the number of cubic inches occupied by the gas in the phial must be noted, together with the temperature of the water in the bason, and the height of the barometer at the time of making the experiment. If one phial is not large enough to contain all the gas, it may be removed before it be quite filled with gas, corked under water, and placed in a vessel of water heated at least to 90 degrees.

This method may be thought in some degree liable to one inconvenience of Bergman's method of separating the gas from the water in a retort, for it may be imagined that the distilled water in the inverted phial will absorb part of the gas, but from experiment this is not the case, for says Dr. Garnett, "I have several times estimated the quantity of fixed air contained in a mineral water, by M. Gioanetti's method, viz. by precipitating it by lime-water, and weighing the calcareous

“earth ; and I have always found the quantity
 “of carbonic acid obtained in this manner,
 “either exactly or very nearly the same
 “as that procured by the machine just de-
 “scribed.”

Experiment 1. Into Garnett's apparatus, three wine pints of Askern water at a temperature of 60° were put, the tin bason filled above the neck of the cylindrical vessel with rain water, and over the neck of the vessel a graduated phial of rain water heated to about 100° was inverted, and another phial ready in the bason, if the former should be too small. On boiling the water, the gas obtained was more than could be contained in one phial owing to its rarified state ; the other phial was then applied, and the heat continued till the volume of aeriform fluid was no longer increased, for bubbles of vapour continued to rise and would do *ad infinitum*,* but as they condensed after bursting, and added no more to the volume of the gas, their nature was easily discovered.

* In separating the gas from water, by means of heating it in a retort, and receiving it over quicksilver, if the process be continued to this point, it is with the greatest difficulty that the quicksilver can be prevented from rising into the retort. In one experiment it rose into the retort though the ascent was four inches perpendicular ; and in another experiment, on applying the finger to the beak of the retort to prevent this from taking place, the suction or pressure from the external air was painfully great.

After making proper allowance for temperature, &c. the product of gas (at the temperature of 60°, and barometrical height of 30 inches) was 4.3 cubic inches.

This exposed to milk of lime for two hours suffered a diminution of 3 inches, and the remainder exposed to the action of hydroguretted sulphuret of lime for four hours, suffered a diminution of .1 of an inch, and after standing six hours longer no further reduction took place, and there remained 1.1 inch.

This experiment gives as gaseous contents of three pints of Askern water 4.3 inches, composed of

Carbonic acid and sulphuretted	
hydrogen,	3.0
Oxygen, .....	.1
Nitrogen,	1.1
Loss, probably owing to the	
transferring of the gasses from	
one vessel to another, .....	.1
	<hr/>
	4.3
	<hr/>

2. Three pints of Askern water boiled, &c. as in the former experiment, afforded 4.2 inches of gas, which was first exposed to heated diluted nitric acid to separate the sulphuretted hydrogen, then to milk of lime to separate the carbonic acid, and then to hydroguretted sulphuret of lime to separate the oxygen.

The results of this experiment were

Sulphuretted hydrogen	1.4
Carbonic acid.....	1.4
Oxygen .....	.1
Nitrogen	1.2
Loss .....	.1
	<hr/> 4.2 <hr/>

The nitrogen gas was exposed for twenty-four hours in a glass tube containing a stick of phosphorus, and inverted over water, but without any diminution in its volume, therefore no doubt can remain as to its nature, and the small proportion of oxygen evinces that the nitrogen cannot be merely owing to the presence of atmospheric air.

By taking the medium of these experiments, and adding the loss to the larger proportioned gasses, the gas contained in three pints of the water will be

Sulphuretted hydrogen	1.5
Carbonic acid	1.5
Oxygen .....	.1
Nitrogen	1.15
	<hr/> 4.25 <hr/>

As sulphuretted hydrogen gas is so easily acted on by metals, there is little doubt but the above quantity is less than the truth, owing to the chemical action of the tinned

iron vessel in which the water was boiled, but this error is corrected by the following experiment.

3. Into a pint and half bottle containing one pint of Askern water, and inverted in a pneumatic trough, about a cubic inch of nitrous gas was let up, and this repeated until the peculiar smell of sulphuretted hydrogen was no longer distinguishable when the bottle was turned up and the water examined. The water being slightly heated, and a few drops of nitric acid added to prevent the precipitation of the earthly carbonates, and then the water filtered through a double filter, and the filters dried, the difference of weight between the inner and outer filter was .25 of a grain, and admitting this to be sulphur from the decomposition of the sulphuretted hydrogen gas, the proportion of the gas is easily calculated. According to Kirwan, one grain of sulphur denotes 3.33* cubic inches of sulphuretted hydrogen gas, and hence .25, that is a quarter of a grain of sulphur, must denote .8325 of an inch of sulphuretted hydrogen in a pint of the water.

By dividing the results of Experiments 1 and 2 by three, and by substituting the result of this experiment in place of the proportion

* Kirwan on Mineral Waters, page 195.

of sulphuretted hydrogen indicated by Experiments 1 and 2, we find the gaseous contents of one wine pint of Askern water* to consist of

	<i>Cubic inches.</i>
Sulphuretted hydrogen . . . . .	.8325
Carbonic acid . . . . .	.5
Oxygen . . . . .	.0333
Nitrogen . . . . .	.3833
	<hr/>
	1.7491
	<hr/>

SECT. 3.—*Of the Analysis. Estimation of the solid Ingredients.*

Experiment A.—Two pints of the recent water was boiled for a quarter of an hour, and a flocculent precipitate was deposited, which, being separated by filtering, and dried at about 170°, weighed 8.4 grains. The precipitate in this and the following experiments, unless mentioned otherwise, was separated by filtering the liquid containing the suspended precipitate through a double filter, and then dried in a water bath, constructed on a plan similar to that given by Dr. Marcett,

* This applies to the Manor-Well, the gaseous contents of the Old Bath are in a less proportion.

in his analysis† of the Brighton Chalybeate Spring.

The 8.4 grains obtained from the above experiment, may be presumed to consist of carbonate of lime, sulphate of lime, and carbonate of alumina, as they are indicated by Experiments 9, 13, and 15, in pages 30—2; but carbonate of magnesia being incompatible with sulphate of lime, cannot be expected.

Diluted muriatic acid in excess, added to a few grains of this deposite, occasioned a brisk effervescence, and it ceasing, the peculiar taste of muriate of lime was perceptible, and some of the precipitate remained undissolved.

B.—The water remaining after separating the deposite in Experiment A, afforded from evaporation a quantity of opake saline matter, which from its general insolubility seemed to consist principally of sulphate of lime.

The preliminary Experiments A and B being repeated with various quantities of water, gave, as the average product of four pints of water, an earthy powder, principally earthy carbonates, 16.8 grains; and saline matter, principally sulphate of lime 44.6 grains, this saline matter increased in weight about 8 grains, after remaining about three weeks in an ordinary dry room, and wrapped in paper. These products

† Saunders on Mineral Waters, page 357.

were kept separate, and used in the following experiments to dissolve in water, &c. for the purpose of assaying.

C.—Four pints of the water evaporated in a glass vessel to one pint, afforded a greyish white deposite, which, being collected and dried, weighed 18.5 grains. It was in the form of an earthy powder, and mixed with some shining particles, which, being examined through a magnifying glass, appeared congeries of crystalline spiculæ.

D.—To 18 grains of this deposite, diluted muriatic acid was added in excess. A few grains of the deposite from A was also treated in the same manner, as an assaying liquor. Portions of the filtered solution of the assay liquor were tested with baryta water, and muriate and nitrate of baryta,—from the precipitate they afforded, the presence of sulphuric acid was evinced. Other portions were tested with oxalic acid and oxalate of ammonia, and the copiousness of the precipitate instantly formed, showed the presence of lime in considerable proportion. Ammonia was added to a third portion, but as no visible effects were produced, the absence of carbonate of magnesia may be considered as proved. In the muriatic solution then, is contained lime and sulphuric acid, as well as the lime combined with muriatic acid, arising from the decomposition of

carbonate of lime. Kirwan (p. 198) mentions selenite or sulphate of lime as '*perhaps*' soluble in muriatic acid, but from the above results there can be no doubt of it.

In attempting to ascertain the quantity of carbonate in the 18 grains of deposit submitted to experiment, it is necessary for the real quantity of sulphate of lime held in solution to be known, that it may be deducted from the weight of the deposit dissolved, as after this deduction the remainder must be carbonate of lime. Sulphate of lime is soluble in 460 parts of water at a medium temperature, now assuming its solubility to be the same in diluted muriatic acid, we have data from which to proceed. A quantity of water was accordingly passed through the filter several times, to make the muriatic solution equal to 500 grains, which would contain dissolved one grain of sulphate of lime.

During the action of the muriatic acid on the deposit, the carbonic acid evolved was attempted to be collected, but from the imperfection of the apparatus a considerable quantity escaped, and only 4 ounces by measure were collected; however as 1 ounce by measure indicates about 2 grains of carbonate of lime, the quantity of carbonate of lime in the deposit dissolved must exceed 8 grains. The solution was filtered, the filter containing the

insoluble matter dried and weighed, and from the weight gained, 4.2 grains of insoluble matter were indicated, which must be carbonate of alumina and sulphate of lime; and the 13.8 grains dissolved must be (with the exception of 1 grain of sulphate of lime) carbonate of lime. This insoluble matter could not be completely separated from the filter, but 2.9 grains being collected, it presented the appearance of silky spiculæ, mixed with a very small portion of greyish brown powder; therefore if carbonate of alumina be present, it must be in very small quantity.

E.—Of the insoluble matter remaining after the action of muriatic acid, 1 grain was treated with 500 grains of distilled water, and after standing about a fortnight the spiculæ were dissolved and the supernatant liquor separated from the insoluble brownish matter, and tested with nitrate of baryta and oxalate of ammonia, afforded with the former a white cloud, and with the latter an instant milkiness, indicating, as had been presumed, that the silky spiculæ were sulphate of lime. The insoluble brownish matter dried in the usual manner weighed .1 of a grain, therefore .42 would be the proportion in the 4.2 of the insoluble matter in Experiment D.

From the results C. it appears that 4 pints of Askern water afford by partial evaporation

18.5 grains of deposite, and by reducing the results obtained by the above examination of 18 grains of the deposite, to the proportions appropriate to 18.5 grains, we find this quantity to consist of

Carbonate of lime	13.16
Sulphate of lime	4.91
Carbonate of alumina .	.43
	<hr/>
	18.5 grains.
	<hr/>

F.—The deposite being separated, the remaining water was transparent, and of a light yellowish red colour. Continuing the evaporation the colour became deeper, and when the evaporation was complete the solid mass weighed 45.4 grains, and principally consisted of small angular grains, among which were some opaque spiculæ. The lower part of the mass was white, with a slight tinge of yellowish grey, and the upper surface was covered with a pellicle of a brownish red colour. The pellicle emitted a peculiar smell, something like the crust of new baked bread. After remaining a few days in paper, the mass became rather damp, particularly the pellicle. The taste of the mass in general was meagre and empyreumatic.

From the mass well mixed together, 44 grains were submitted to examination, which,

from the experiments in Section 1,* may be sulphate of lime, sulphate of soda or potash in minute proportions, sulphate of magnesia, muriate of lime or perhaps of magnesia, muriate of an alkali, and also vegetable extractive matter. Nitrates cannot be expected, and their absence is also negatived by no deflagration arising from a little of the salt sprinkled on ignited coals, and from the filters used in separating the salt not deflagrating when thrown into the fire.

Of the salt obtained in B, 5 grains were mixed with 4 ounces of distilled water to use as an assay liquor, this liquor being of course nearly similar to the original water when in a concentrated state, and deprived of its gasses and carbonates. The 4 ounces of water did not dissolve the whole of the 5 grains. The insoluble part consisted of small opaque spiculæ, and quickly subsided after agitation.

The solution had a slight tinge of red. Being filtered, different small portions were tested for lime, magnesia, sulphuric acid, muriatic acid, and extractive matter, thus:—Treated with sulphuric acid, no change—hence no great proportion of muriate of lime; oxalate of ammonia, instant precipitate—hence

* Vide the inferences from, and summing up of, the experiments at the conclusion of Section 1, p. 37—8.

lime; ammonia, a white cloud—hence magnesia; nitrate of baryta, an instant white cloud and precipitate—hence sulphuric acid; nitrate of silver, a white cloud and faint brown tinge, probably extractive matter. As the effects of these tests corroborate the results of Section 1, p. 38, we may expect to find the 44 grains of matter submitted to examination to consist of the substances above enumerated.

To separate these substances, they were treated with portions of alcohol and water, on the principle of their relative solubility in these menstrua.

100 grains of alcohol, of the specific gravity of 900, will readily dissolve .21* grains of muriate of magnesia, 4.5 of muriate of lime, and 5.5 of muriate of soda; but the same quantity of similar alcohol will dissolve neither sulphate of soda nor sulphate of lime, nor sulphate of magnesia unless a day or two be allowed, and then only 1 grain will be taken up. Extractive matter is soluble in alcohol.

G.—To 44 grains of the mass obtained by evaporating to dryness, 200 grains of alcohol were added, after frequent agitation it was allowed to settle, and the clear solution separated by a syringe, the insoluble matter was then washed with other portions of alcohol,

* Vide Kirwan's Tables.

making in the whole 300 grains. The insoluble residue dried in the usual manner weighed 41.1, of course the muriates and extractive matter must be 2.9 grains. The alcoholic solution was of a wine yellow colour; evaporated and dried in an oven it became a sponge-like mass of a yellowish brown colour, smelled like burnt coffee and garlic, and weighed 2.6 grains. It had a peculiar burnt taste, something like the taste of coffee, yet the bitter saline taste of muriate of lime or magnesia was also very perceptible, but no crystals distinguishable, nor any taste of muriate of soda. After standing twenty-four hours in a dry room, this brown matter became very moist, nearly in a state of solution. Perhaps this was partly from the action of the atmosphere on the extractive matter, or perhaps solely from the muriates, but in this stage of our inquiry the consideration of it is of no consequence.

The quantity of solid matter obtained from the alcoholic solution was 2.6 grains, but the quantity indicated by weighing the insoluble matter was 2.9 grains, therefore there is a loss of .3 of a grain, probably owing to the extractive matter, which may have been partially destroyed by the high temperature employed in drying it, and it may also have acquired from the same source its peculiar odour; this circumstance, however, would not affect muri-

ates, particularly the muriate of lime, which, from its extreme proneness to attract moisture, is difficult to obtain dry enough to submit to weighing.*

H.—The 2.6 grains of the brown matter were dissolved in distilled water, and acetate of silver added to separate the muriatic acid, the precipitate of muriate of silver which ensued, being separated by drawing off the liquid with a syringe, and dried at 160° , weighed 3.4 grains, from which the actual quantity of muriatic acid may be deduced, for according to Kirwan, 100 parts of muriate of silver indicate 16.54 of acid, and therefore 3.4 grains of muriate indicate .56236 of a grain of muriatic acid, which must be the quantity existing in all the muriates dissolved by the alcohol.†

I.—After the separation of the muriate of silver, the solution will consist of acetates of the earths and alkalies previously existing in the state of muriates, which may be lime, mag-

* From the dark colour of this substance, Exp. F and G, its garlic-like smell when high dried, its solubility in alcohol, and, after it has been frequently dried at a high temperature, its partial solubility in water, it appears to be (if not precisely the same) approaching to the same nature as what Westrumb calls *stinkendes schwefelharz*, i. e. fetid resin of sulphur.—Vide Retrospect of Chy. vol. 4, p. 71—2.

† The proportions appear more distinctly by stating them thus: As 100 mur. of silver is to 16.54 mur. of acid, so is 3.4 mur. of silver to .56236 mur. of acid.

nesia, soda, and potash. This solution of acetates evaporated to dryness, some of the brown extractive matter was deposited, and some transparent long crystals formed on the glass. After standing twenty-four hours the crystals became moist, and presuming this absorption of moisture from the atmosphere not to be owing to the extractive matter, it indicates the presence of acetate of potash, or perhaps of magnesia.

These crystals and extractive matter were re-dissolved in water, and filtered to separate the extractive matter, which was rather diffused than dissolved; and to the solution oxalate of ammonia was added to throw down the lime present, and the oxalate of lime precipitated, being separated and dried, weighed .2 of a grain. Now according to Bergman, 100 grains of oxalate of lime contain 46 grains of pure lime,* therefore this .2 of a grain must contain .092 of a grain of lime. From the authority of Kirwan, we know that 100 parts of lime combine with 84.488 parts of muriatic acid, therefore the quantity of acid which .092 of a grain of lime would combine with, would be .0777 of a grain of muriatic acid; and as muriate of lime, even when exposed to a red heat, contains water in the proportion of 8 parts of

* Bergman's Essays, by Cullen, vol. 1, p. 317.

water to 42 of muriatic acid, the proportion of water to .0777 will be .0146; and adding these to the .092 of a grain of lime, the quantity of muriate of lime in 44 grains of the salt employed in Experiment C, is .1843 of a grain.*

From Experiment H, it appears the quantity of muriatic acid present in the alcoholic solution was .5623 of a grain, but the lime present has only been combined with .0777 of a grain, and deducting this from the former, the quantity remaining must have been combined with other bases.

Muriatic acid present, . . . . .	.5623, &c.
The portion combined with lime, .0777, &c.	
	<u>.4846</u>

This .4846 of a grain may have been combined with magnesia or a fixed alkali, or both.

K.—From Experiment I, it may be presumed that potash existed, though an unusual ingredient in mineral waters. To ascertain this, the liquid remaining after the separation of the muriatic acid by acetate of silver, and the lime by oxalate of ammonia, was mixed

* As 100 ox. of lime is to 46 of lime, so is .2 ox. of lime to .092 of lime; and as 100 of lime is to 84.488 mur. acid, so is .092 of lime to .0777 mur. acid, &c. and as 42 mur. acid is to 8 of water, so is .0777 mur. acid to .0146 of water; and .092 of lime, with .0777 mur. acid, and .0146 of water, are equal to .1843 muriate of lime.

with a few drops of muriatic acid to throw down any silver remaining in solution; the clear liquid being separated, by drawing it from the precipitate with a syringe, a little of it was then mixed with a solution of muriate of platinum,* but as no precipitation ensued the absence of potash was evinced, for it is a property belonging to salts having potash for their base, to throw down a yellow precipitate on mixing with muriate of platinum.

We may now infer that the absorption of moisture from the atmosphere, noticed in Experiment I, was not owing to the presence of acetate of potash; and also that the muriatic acid not combined may have been in part, if not entirely, combined with magnesia. The presence or absence of magnesia in the muriates has not been positively determined, but as acetate of magnesia is extremely prone to become moist by exposure to the atmosphere, there is great reason to suppose it present, and also as muriate of magnesia like muriate of lime attracts moisture from the atmosphere, has a bitter taste, like it too is with difficulty obtainable in the form of crystals; which circumstances, as they agree with the characters of the saline matter obtained from the evapora-

* The habitudes of this salt, with the alkalies, were pointed out by Bergman.

tion of the alcoholic solution in Experiment G, may be considered as establishing the presence of magnesia, and its being the base combined with the .4846 of a grain of muriatic acid, and proceeding on this principle the quantity of muriate of magnesia is 1.4 grain. For as 100 grains of muriate of magnesia contain 34.59 of muriatic acid,* 1.4 of muriate of magnesia will contain about .4846 of a grain of muriatic acid.

By collecting and comparing Experiments G, H, I, and K, we find that 2.9 grains of solid matter soluble in alcohol consisted of

	<i>Grains.</i>
Muriate of lime, .....	.1843
Muriate of magnesia,	1.4
Matter not saline, including .3	
of loss,.....	1.3157
	<hr/> 2.9 <hr/>

The above is the quantity of muriates and vegetable extractive matter contained in 44 grains of the solid matter obtained in Experiment F; but as 45.4 grains were contained in 4 pints of water, the quantities of these are rather too small, and when proportioned to 45.4† will be

* Kirwan on Mineral Waters,—Table IV.

† The calculation carried to a third or fourth decimal figure would not answer any useful purpose, yet it is proper to notice that these proportions are about a two-thousandth part too small in the whole product.

Muriate of lime, .....	.19
Muriate of magnesia,	1.45
Matter not saline, which may be denominated fetid resin of sul- phur,	1.35
	<hr/>
Grains	2.99
	<hr/>

Being the muriates and matter not saline in four pints of Askern water.

L.—The salts remaining, after separating the muriates by alcohol in Experiment G, weighed 41.1 grains, from the indications of the tests as collected at page 37—8, and again considered in Experiment F, may consist of sulphate of lime, sulphate of soda or potash in small proportion, and sulphate of magnesia in small proportion. To these 41.1 grains of saline matter 230 grains of distilled water were added, which supposing the whole saline mass to be sulphate of soda or magnesia, this quantity of water would dissolve it, and supposing the greater part of the mass were sulphate of potash, that also would be soluble in this quantity of water. But as this quantity of water would only dissolve half a grain of sulphate of lime, its efficiency in separating the alkaline and magnesian sulphates from the sulphate of lime is sufficiently evident. After frequently stirring

the mixture and allowing it to stand a few hours, the insoluble matter was separated from the liquid, and washed with a little more water, to clear it of any of the former remaining in the filter, and being dried in the usual manner, weighed 36.2 grains. This product had a meagre feel and taste, did not effervesce on mixture with muriatic or sulphuric acid, and being heated to redness, and mixed with water, formed a paste which hardened in a short time, so that no doubt remained of its nature, as no salt except sulphate of lime possesses these properties.

M.—The solution evaporated, from the last experiment, afforded some prismatic crystals of a bitterish saline taste, some of which being re-dissolved and treated with muriate of platinum produced no visible effect, hence *no potash*. Oxalic acid gave no instant precipitate, hence *no lime*. Carbonate of soda gave an instant white cloud and precipitate, and ammonia threw down a similar precipitate, which in both cases was immediately re-dissolved by adding either sulphuric or muriatic acid, so that the presence of sulphate of magnesia was sufficiently clear. From Experiments L and M, the sulphates are sulphate of lime and of magnesia. The sulphate of lime being from the product of Experiment L, 36.2 grains, to

which must be added .5 of a grain as remaining in solution in the 230 grains of water, making the whole to be

	<i>Grains.</i>
Sulphate of lime,	36.7
Sulphate of magnesia, . .	4.4
	<hr/>
	41.1
	<hr/>

As these 41.1 grains are only a proportion of 44. and as 45.4 grains were the quantity of solid matter which was obtained in Experiment E, the quantities of the sulphates are rather too small, and when proportioned to 45.4 will stand thus:—Sulphate of lime 37.9, sulphate of magnesia 4.5, including some traces of sulphate of soda, Exp. 17, Sect. 1, making the sulphates in four pints of Askern water 42.4 grains. Admitting that sulphate of soda exists, it must be in very small proportion, because it is not only incompatible with muriate of magnesia and muriate of lime, but also must be included in the 4.5 grains; and it seems propable that the minute granular precipitate in Section 1, Experiment 17, might arise from a small quantity of the oxalic acid remaining in the solution, and slowly decomposing the nitrate of lime, so that on the whole the existence of any sulphate of soda is very doubtful.

By collecting the solid products as obtained by the investigations occupying this section, we find that four pints of Askern water yielded by partial evaporation 18.5 grains, and by continuing the evaporation to driness 45.4 grains more, making together 63.9 grains, which consisted of

	<i>Grains.</i>
Sulphate of lime,	42.81*
Sulphate of magnesia,	4.5
Carbonate of lime,	13.16
Carbonate of alumina, . . . .	.43
Muriate of lime, . . . . .	.19
Muriate of magnesia,	1.45
Fetid resin of sulphur,	1.35
Loss, . . . . .	.01
	<hr/> 63.9 <hr/>

The loss is probably owing to the calculations not being carried to a greater degree of precision, but it is so small as to be of no consequence; and most likely would have been considerably larger, if all the results had been weighed quantities, instead of having been (as in several instances) estimated by calculation.

* Sulphate of lime, dried at 160° or 180°, contains about 14.38 per cent. of water, therefore 42.81 grains contain 6.15 of water.—Vide Kirwan,—Table IV.

The preliminary Experiments A and B give the quantity of solid matter in four pints of Askern water at 61.4 grains, which is 2.5 less than the above, but yet they accord as near as can be expected; for were 120 grains of the principle ingredient, sulphate of lime, to be divided in two portions, each mixed with water and then dried separately, on weighing they would very likely be found to differ two grains and a half, so difficult it is to obtain precisely the same degree of dryness.

SECT. 4.—*Of the Analysis. Conclusion.*

Most salts, and consequently the saline ingredients obtained from mineral waters, may exist in two states of dry solidity, namely, in a crystallized state, in which they have a quantity of water united with them, and efflorescent, or entirely deprived of their water of crystallization. In which of these states, as products from a mineral water, ought their weights to be estimated?

The ancient chemists, and some of the more modern, have estimated their weights in the crystallized state, but from many conclusive

reasons,* and particularly as the water of crystallization is not always the same even in the same species of salt, this mode of estimation is now generally abandoned. In looking over the results of analyses, the states in which the salts are estimated should always be kept in view, because many salts in a crystallized state contain half their weight or more of water. This is the case with sulphate of magnesia or Epsom salt, and some others, so that in an analysis of the same water by different persons, if the quantity of salt in a certain quantity of the water were stated by one at 6, and by the other at 13, though the latter might seem the larger quantity, yet if in it the salt were crystallized, and in the former deprived of its water of crystallization, the quantities of real saline matter would be very nearly the same.

All the salts obtained in the foregoing analysis may be deprived of their water of crystallization at 160° or 180° , and have been estimated in that state, except the sulphate of lime, which in its native state of selenite or gypsum seems to hold water as a necessary part of its composition, and unless it be made red hot this cannot be driven from it; but that all the salts may appear in their pure saline state, as nearly as the nature of the

* Vide Kirwan on Mineral Waters, p. 150.

analysis will admit, in the results as presented at the conclusion of this chapter, an allowance (vide note, p. 62,) has been made for the water contained in the sulphate of lime.

There is also another question nearly connected with the above, viz. Do the results, obtained by analyzing a mineral water, present the salts that actually exist in the water, or only saline substances arising from the *decomposition* of the salts actually existing? On this subject a very elaborate paper has been written by Dr. Murray,* from which it appears that an exchange of principles between the acids and bases may in many instances take place, and from this the Doctor thinks the medicinal powers of many mineral waters can be satisfactorily accounted for; but that Dr. Murray's arguments do not apply to Askern water, a few moments consideration will prove. The acid most abounding in the products of Askern water is the sulphuric, and the base most abounding is lime, which is in a greater proportion than is equivalent to the saturation of all the sulphuric acid, therefore it may be reasonably expected that the salt actually existing in greatest proportion in the water, must be sulphate of lime. Magnesia is another

* An Analysis of the Mineral Waters of Dunblane and Pitcaithly, &c. by Dr. Murray. *Annals of Philosophy*, 1815, vol. VI. p. 848.

base present, and supposing it were all combined with sulphuric acid, it would not make the quantity of sulphate of magnesia 1.5 grain more than is obtained from the analysis; but even this cannot be the case, as the muriatic acid existing in the muriate of magnesia is not an equivalent (in point of its power of saturation) to the lime, which would be equivalent to the neutralizing the sulphuric acid which the magnesia, to form sulphate of magnesia, would saturate, so that a certain portion of lime would be either in an uncombined state, or the acid with which it was combined must have disappeared, but as such a supposition is unsupported both by analogy and experiment, we may conclude that in the analysis of Askern water during evaporation, no exchange of principles can have taken place between the acids and salifiable bases.

Though no exchange of principles takes place between the acids and salifiable bases, yet the fetid substance (Exp. G and H) most probably is derived from some chemical action which occurs during the evaporation of the water, but with the precise nature of which we are unacquainted. It probably may be from the action of the sulphuretted hydrogen on some bituminous matter.

The presence of this resinous substance is a striking trait in the character of Askern water,

as this substance, or a substance of a similar nature, has not been detected in Harrogate, Moffat, or any mineral water in this island; and the only waters which I have found recorded as containing a similar substance, are the baths of Eilsen and St. Amand, which, according to Westrumb, contain the resin of sulphur, and in the dark mud which accumulates around the baths the same substance is found; and the waters of Barege, a village on the north side of the Pyrenees, near the source of the Adour, which also, as stated by Dr. Saunders, on the authority of the analysis by Messrs. Montaut and Pagez, afford a "bituminous substance of a nature but little known," and likewise deposits it "in the channel of the water, forming a black unctuous mud, that yields ammonia by distillation."*

Askern water seems not to have been subjected to chemical examination prior to the

* The bluish coating and mud; noticed in the account of the physical characters of Askern water, (p. 27) as found on the sides and bottom of the Manor-Well, may probably contain a bituminous substance. The deposite at the bottom of the boilers, when treated with muriatic acid, yielded sulphuretted hydrogen, and by the addition of oxalate of ammonia, lime was indicated in the solution. On placing some of the deposite in powder on a hot iron, it emitted the odour of sulphur. From this cursory examination, compared with the results obtained from the analysis of the water, it is probable that the deposite in the boilers is composed of sulphate of lime, carbonate of lime, and sulphuret of lime.

present attempt,* since chemistry attained the rank which it now holds among the sciences. The analysis by Dr. Short is sufficient for the purpose of comparing its quantity of solid matter and its general characters with those of other mineral waters in the same work, but the actual information it affords is very limited; nor is this to be wondered at, for the chemical history of saline bodies was very confused until the publication of Bergman's works, whose discoveries, if they were made when Dr. S. wrote, were not published till afterwards. From perusing Dr. Short's work, especially the preface, it appears that his ideas of saline bodies were very discordant; even nitre, a name which by Mayow, a chemist who preceded him, and by chemists of the present day, is applied to a peculiar salt that deflagrates on ignited coals, Dr. S. applies to a salt, or rather to salts, that appear to be very common in mineral waters, but which do not deflagrate

* In Elliot on Mineral Waters, 1789, p. 125, the water of "Askeron, five miles from Doncaster," is stated as containing per gallon "48 grains of vitriolated magnesia, with a little sea salt, and a dram and a half of earth," (90 grains.) This statement appears to be taken from Dr. Short, by assuming what he calls salt to be vitriolated magnesia and sea salt, as the quantities *exactly* accord with Dr. S.'s proportions of solid matter, viz. 144 grains, of which 6 grains seem to be assumed as sea salt. In Nicholson's Dictionary of Chemistry, 1810, the composition of "Askeron" water is given, but appears to be copied from Dr. Elliot's work.

when thrown on burning coals. What Dr. S. precisely means by nitre it is difficult to ascertain, but he generally applies this term to salts that exhibit slender or long prismatic crystals.

It is not intended to assert that the present analysis is perfect, far from it, it is only an approximation to what might even now be done, though it approximates nearer to precision than what has been done.

The results of Dr. Short's analysis, reducing the proportions to four pints of the water, are

	<i>Grains.</i>
Earth.....	48
Salt.....	24
	<hr/>
	72
	<hr/>

The peculiar salt of which the 24 grains consist, and which Dr. Short denominates nitre and marine salt, may have been the salts most soluble, and the 48 grains of earth the carbonates and sulphate of lime. The whole 72 grains agree nearer than one would expect, considering the little attention then paid to the drying of the salts and weighing of the quantities.

The analysis* in the preceding pages, collected from the results of Sections 2 and 3,

* Both the Manor-Well and Old Bath vary in their sulphureous impregnations at different times, being generally weaker in a wet season, and also somewhat weaker towards evening.

gives 63.9 grains of solid matter, and includes a certain quantity of water solidified in the sulphate of lime, which being deducted, the actual results obtained from the water of the Manor-Well,* are

Gaseous ingredients in four wine pints of Askern water.

	<i>Cubic inches.</i>
Sulphuretted hydrogen gas,.....	3.33
Carbonic acid, or fixed air,.....	2.
Oxygen, or vital air,.....	.1332
Nitrogen, or mephitic air,.....	1.5332
	<hr/> 6.9964

Salts, &c. in four wine pints of Askern water.

	<i>Grains.</i>
Sulphate of lime,	36.66
Sulphate of magnesia, or Epsom salt,	4.5
Carbonate of lime,	13.16
Carbonate of alumina, .....	.43
Muriate† of lime, .....	.19
Muriate of magnesia,.....	1.45
Fetid resin of sulphur,	1.35
	<hr/> 57.74

* The solid ingredients of the Old Bath are of the same kind, as also are the gaseous ingredients, but the sulphuretted hydrogen is in smaller proportion.

† If the views of Sir H. Davy, Dr. Thomson, &c. of the composition of this substance be correct, the term muriate is inadmissible. In the language of the former it ought to be calciane, but the latter, adhering to the received rules of chemical nomenclature, names it chloride of lime.

CHAP. III.

OF

THE USE

OF

COMMON WATER & ASKERN WATER.

 SECT. 1.—*The internal Use of Common Water.*

WATER in a state of perfect purity can only be obtained by distillation, but as different natural waters differ in their effects on the animal system, and as this difference is owing partly to the nature of the foreign ingredients, and partly to their proportion compared with the pure liquid menstruum, it is necessary that we should first attend to what effects are attributable to mere water, before we can discover what arise from foreign ingredients.

Pure or distilled water has so seldom been used as a continued article of diet, that we have not, to my knowledge, any publications or records of experiments on the subject, except what Dr. Lambe presented to the republic of

medical literature, in 1805.* From Dr. L.'s experiments it appears, that the use of distilled water produces medical effects similar to what arise from Malvern water, and is particularly serviceable in gout, scrophula, consumption, and cancer, which good effects Dr. L. supposes to arise from "avoiding the application of deleterious and poisonous matter, daily introduced into the system, perhaps in many ways, but principally and most abundantly, under the attractive and unsuspected form of water."†

The noxious matters which exist in water in general, the Doctor conceives to arise from animal substances, which must be most abundant in populous and civilized communities, and that no method will free water of this "*septic poison*" but careful distillation. Without entering at present into the particular object of Dr. Lambe's work, or attempting either to refute his opinions or acquiesce with them in what relates to the cure of particular diseases, it must be acknowledged that the subject is worthy of further investigation, and that he satisfactorily proves *that a diet of distilled water is not only not injurious, but absolutely beneficial in some complaints*, even when

* An Inquiry, &c. into constitutional Diseases, by W. Lambe, M. D.—1805.

† Ibid p. 12.

the patients are stated to have been water drinkers and temperate.

Some natural waters approach in purity to distilled water. Malvern water, in Worcestershire, presents a notable example of this kind, and from its long and well-known celebrity, the effects it produces on the animal system have been repeatedly corroborated.

The internal use of Malvern water,* is sometimes attended at first with a slight nausea, and not unfrequently with some drowsiness, vertigo, or slight pain in the head, which comes on a few minutes after drinking it. In a few days these symptoms go off. The effects in the bowels are in some cases purgative, in others constipating, the latter effect occurring more generally to those who are accustomed to malt liquors. In all cases it decidedly increases the flow of urine, and the appetite and spirits invariably improve during a course of it. Malvern water, though enumerated as a mineral water, is in fact what in common language would be called *good soft water*, and the small quantity of foreign ingredients obtained by chemical analysis, shows that its medical effects can only arise from its purity.

* Saunders on Mineral Waters, p. 109.

Another instance of a spring remarkable for the purity of its water and its medical celebrity, occurs near Osterode, a mine town in the Hercynian forest, in which not a particle of mineral ingredients can be detected.*

The natural waters that approach to the above in purity, are rain and river water, the former of which is the more pure, unless when it is contaminated by falling on a dirty surface, or running along impure channels, as the roofs, of houses, spouts, &c. Spring water may, as from the above instances of Malvern and Osterode, be very pure; but as all mineral waters are in reality derived from springs, it is evident the degrees of the purity of spring water are almost infinite, but as we are about to consider the use of natural water as an article of medicine, it is necessary that some specific characters be fixed on, that the pure and impure varieties may be distinguishable.

Waters generally used for domestic purposes are distinguished into two kinds, hard and soft, the former possesses a peculiar harshness to the touch when the hands are washed in it, and is incapable of dissolving soap without decomposing or curdling a part of it; the latter

* Lambe's Inquiry, p. 38, quoted from Hoffinani opera, tom. V. p. 206.—Genevæ, 1740.

is soft to the touch, and dissolves soap without decomposing it. These differences arise from the impurities in hard water consisting of earthy saline substances, and the hardness of the water is in proportion to the quantity of these ingredients, of course the purer the water the softer it is.

If water be soft, transparent, colourless, and without any perceptible vegetable or animal impregnation, it may be considered as excellent for most domestic purposes, and such water we shall call *pure native water*, in the following pages, from whatever source it may be obtained; whether from springs, rivers, or rain; and waters that are indiscriminately used for domestic purpose, we shall call *common water*.

When we view the very numerous species of animals which in their natural state use no other liquid food but water; it must strike every one that water is either absolutely necessary for their support, or universally grateful to the palate; but when we consider that animals both very different in their anatomical structure and habits of life, that both birds and quadrupeds, both carnivorous and graminivorous animals, require water and prefer it to all other liquids, we must infer that an instinct so universally implanted must be universally necessary. Even man, who of all

other animals is least known in a state of nature, uses water as an article of diet, it constitutes the mass of all the liquids he swallows; and this position holds true, even when applied to those persons who, from the intemperate use of stimulating liquids, have acquired a distaste for it in an unmixed state.

As water is so necessary to animal life, and as various foreign ingredients are dissolved and suspended in natural waters, it is certainly reasonable that those waters should be preferable for general use which abound least in ingredients that produce any unpleasant or detrimental effects on the animal system.

Suppose any pure native water were to be used as a medicine in the same manner as Malvern water, there is no doubt but the effects would be similar, and would be most conspicuous in the individuals who were least accustomed to so pure a beverage. As the effects of mere water are so considerable, in judging of the effects of any mineral water, we must attempt to discover what effects belong to the menstruum and what to the substances dissolved, and in doing this our judgment will be much assisted by taking into consideration the previous habits of the patients.

Before concluding this subject, it is worthy of remark, that "water drinkers are in general

longer livers, are less subject to decay of the faculties, have better teeth, more regular appetites, and less acrid eructations, than those who indulge in a more stimulating diluent for common drink.”* This remark is just, whether applied to drinkers of soft or hard water, of river or rain water, or of any water that general experience has taught as applicable to the common purposes of life.

SECT. 2.—*The internal use of Askern water.*

Soon after drinking a glass of Askern water eructations of fetid gas take place, and some of the water occasionally rises into the throat, a sense of weight at the stomach is felt by some, and occasionally a slight nausea, or tendency to sickness. Some cases occur in which drinking the water produces dizziness, and a sensation of fulness in the head.

Half a pint of the water drank two or three times a day may be considered as a medium dose. It is generally drunk cold, but some prefer it warm, and indeed with delicate habits, and those who from drinking it experience a sensation of weight at the stomach, it is found

* Saunders on Mineral Waters, chap. V.

to agree better when taken warm, particularly at the commencement of the course. While continuing the use of the water, the sensible effects above mentioned either cease or become less perceptible. During the course of taking the water, the urine becomes increased in quantity, and in some cases the bowels are considerably relaxed, but in general no laxative effects are produced. These effects vary in degree according to the differences in the constitution, regularity in drinking the water, and the regimen of the patient.

From the external and internal use of the water being generally employed at the same time, it is difficult to say from experience in what particular disorders the mere drinking of the water has been found most efficacious.* It appears to have proved most beneficial in complaints arising from indigestion, or connected with a deranged action of the stomach.

SECT. 3.—*Of Baths, distinguished according to their temperature.*

A bath is the application of water to the surface of the body, and may be general, as in

* The external and internal application of the water, used conjointly, will be considered generally at the conclusion of this chapter.

the immersion of the whole or principal part of the body, or partial, as in the bathing of the feet, &c. But the most material difference in baths is that which depends on the temperature of the water, and hence the necessity of the specific distinctions, into *hot*, *warm*, *tepid* or *temperate*, and *cold bath*.

The **HOT BATH** is of a temperature higher than that of the human body in a state of health. Its temperature commences at 98° , but to what height it may be carried must depend on the sensation of the patient; but water heated as a *hot bath* ought never to exceed, at the first bathing of the patient, 105° . The king's bath, at Bath, is a natural specimen of the hot bath, and has a medium temperature of 116° .

The **WARM BATH** includes a range of temperature not exceeding 97° , nor less than 90° . No example of a natural warm bath exists in this country. The domestic phrase, new-milk-warm, is expressive of a range of temperature not exceeding that of the *warm bath*, though commencing six or eight degrees lower.

The **TEPID OR TEMPERATE BATH**, is that which possesses a temperature of from 65° to 90° . Matlock and Buxton exhibit examples of natural tepid baths, the former having a temperature of 66° , the latter of 82° , and in consequence of this, a bath of common water

at the temperature of 82°, is often, in the language of the sick room, denominated *a Buxton bath*.

The COLD BATH is of the ordinary temperature of the atmosphere, that is from 32 to 65°. Common springs, rivers, and lakes, afford familiar examples of water within this range of temperature.

SECT. 4.—*Of the Effects of Baths of Askern and Common Water.*

In considering the effects of Askern water as a bath, we must look upon it in two points of view, as a bath of common water at various temperatures, and as a sulphureous mineral water under similar circumstances.

As invalids visiting Askern place their chief reliance on the water used indiscriminately in the form of the hot and warm bath, and consider drinking the water as but of secondary importance, the effects of baths of an elevated temperature demand particular consideration.

On entering water heated to the temperature of 98° or upwards, the heat is very striking and permanent, the pulse is increased in frequency and force; the superficial veins become

distended; the face is flushed; the respiration is quickened, and sometimes hurried and laborious. If remaining in the water be continued beyond a few minutes, the arteries of the head and neck throb violently; a sensation of anxiety at the breast, threatening suffocation, comes on, and the person grows giddy and feels a fluttering at the heart.* If these warnings of approaching danger be not attended to, insensibility ensues, and the bather *expires of apoplexy*.

From the violent powers of the hot bath in stimulating the system, its employment is almost entirely limited to cases of great and general torpor of the nervous system, and even then it requires to be used with caution. Askern water employed as a hot bath produces the same succession of effects on the animal system as a bath of common hot water; but were the bather to remain too long in it, the fatal effect would probably be produced sooner; and it is matter of astonishment that such occurrences have not happened, for patients of the most plethoric habits often sit in water heated to the utmost they can bear, without

* The sources from which many of the facts in this section are drawn, are Dr. Saunders's work on Mineral Waters, p. 483, &c. and an excellent essay in vol. 3. of the Edinburgh Encyclopedia, in both of which Dr. Currie's researches relative to this subject are incorporated.

either themselves or the attendant being aware of any danger, and often without an attendant at all, and their time of immersion seems to be guided by no rule except their will, or the arbitrary affirmation of "you have been in long enough," pronounced by the attendant.

The Askern water hot bath has, from the testimony of numbers, been very efficacious in removing rigidity of the joints and numbness of the limbs, arising from repeated attacks of gout and rheumatism. Has it actually been more serviceable than a bath of common hot water? is a question to which a decisive answer cannot, at present, be made, but I am inclined to think that it ought to be in the affirmative, though it is difficult to conceive how the salts contained in Askern water can act in increasing its medical effects in this mode of application, and as to the gaseous substances, they must be disengaged from the water before the patient can become immersed.

Is it possible that the resin of sulphur, which the hot water contains, can act in any specific manner by absorption, or as a stimulant?

There is one variety of the hot bath which deserves notice, though its employment does not seem hitherto to have been thought of amongst the arrangements for increasing the utility of Askern bathing, namely, what is called the *vapour bath*. The universal vapour

bath consists in exposing the naked body to steam, either by the patient entering a heated apartment into which steam is admitted from a tube connected with a boiler, or by throwing a quantity of water upon a heated body in the room.

The vapour bath produces the general effects of the hot water bath ; but the temperature of the body is not so much raised as by the hot water bath, and another material difference is, that a copious perspiration ensues from the whole surface, and on these accounts the danger is less, and the efficacy in relaxing the body and removing obstructions of the skin is greater, than in the hot water bath. The principal danger of the vapour bath is from the first exposure to the heated atmosphere, and hence, in a plethoric state of the body, or where there is much determination of blood to the head, its employment would be hazardous. The application of steam to any particular part of the body, forming what is called the topical or partial vapour bath, can only be viewed as an ingenious mode of fomentation, and is applicable in similar cases. An universal vapour bath from Askern water, might be so contrived as to form an efficient application of the gaseous products of the water, and the peculiar effects of these, combined with the general perspiration and relaxation of the skin

arising from the aqueous vapour, might be particularly efficacious in some chronic eruptions with a dry scurfy or scaly state of the skin, and the efficacy might perhaps be increased by alternating the employment of the vapour bath with the warm bath, the latter possessing more detergent or cleansing powers. These, however, are but plausible conjectures, the test of experience being wanting.

The effects of a *warm bath* of common water are—An agreeable sensation on entering the water, and this sensation is more striking in proportion as the body has been previously cooled. Except the water be kept near the highest degree of temperature of the warm bath, viz. 97°, the sensation of heat, contrary to what happens in the hot bath, soon diminishes, leaving only a pleasant feeling of a moderate and natural temperature. During the continuance in the water, the pulse is diminished in frequency, (which is also quite the reverse of what occurs in the hot bath) and it is remarkably so in those cases in which before immersion it was preternaturally increased. The diminution of the pulse goes on during a continuance in the warm bath, though the water be preserved at nearly its original warm temperature, insomuch that a natural pulse, after immersion of an hour and a half, has been reduced by nearly twenty beats in a minute.

The respiration is rendered slower, and the animal heat is in most cases diminished. After immersion, the absolute weight of the body is found to be increased, notwithstanding the perspiration that commonly takes place during immersion; and the patient feels a peculiar languor and desire of repose, though the spirits are exhilarated, and any previous irritability allayed.

The warm bath relaxes the skin; and on the constitution the effects have also been supposed relaxing and debilitating, but this opinion is now, from more rigorously attending to facts, found to be erroneous, and the effects quite the opposite, as it restores strength to persons debilitated by disease.

The warm bath is used with success in a variety of diseases, among which, as connected with our present inquiries, may be enumerated cutaneous eruptions, stiff joints from rheumatism and rheumatic pains, paralytic affections, obstructions of the bowels, and general debility attended with nervous irritability, these being complaints for which the warm bath has not merely been prescribed, but in which it has really proved beneficial. And Askern water seems not only equally useful in any of these affections, but in rheumatic affections appears to be more useful, and in cutaneous eruptions is decidedly superior to mere warm water.

Some difference of opinion has prevailed among medical men, as to the propriety of using the warm bath in tuberculous pulmonary consumption, but I have seen it used with evident advantage at Askern, in cases wherein the hectic paroxysms have been regularly formed, and the cough and frothy expectoration considerable; and also in cases more advanced, as when the expectorated matter has become more viscid and opaque, and occasionally curdly and streaked with blood. In the employment of the warm bath in pulmonary consumption, it must be acknowledged that much caution is requisite; but if the patient have tried it, and found the heat of the skin lessened, the pulse slower, and the cough and uneasiness in the chest alleviated, there can be no objection to a continuance of its use.

The effects of a *tepid or temperate bath* of common water on first immersion are negative, or in other words, no particular sensation of heat or cold is felt. As 85° are about the ordinary temperature of the human body, to a person heated by exercise a tepid bath may feel cold, while to another that has been long in undressing, or in any way cooled below the usual standard, it will feel sensibly warm. By remaining in the bath for some time, the limbs are rendered supple, stiffness arising

from fatigue or great exertion is removed, and the natural perspiration is promoted, by the skin being freed from that scurf or bran-like substance which collects on the bodies of even the most healthy persons. The common tepid or temperate bath is useful in chronic rheumatism, and in cutaneous eruptions in general. In the same complaints a temperate bath of Askern water is of use, and in many species of cutaneous eruptions of much greater utility, though, from the general practice of using water heated to a high temperature, the effects of the tepid bath are not so well established. By using the temperate bath, the sulphuretted hydrogen gas would be applied with more economy, and more directly to the body, than in the warm bath; therefore, in those eruptions wherein this ingredient is particularly indicated, a tepid bath would probably be the most efficient mode of using Askern water.

Among the medical uses both of the hot, the warm, and also the tepid bath, have been mentioned the removing stiffness of the joints and rheumatic pains, and to prevent any perplexity in the mind of the unprofessional reader, it is necessary to explain;—that the hot bath is applicable to rigidity of the limbs from long continued cases of chronic rheumatism, unaccompanied by pain when warm in bed, and when the warm bath has proved inefficacious.

The warm bath is applicable to the same cases as the former ; but being without the danger accompanying the improper use of the hot bath, and often equally efficacious, it ought in all cases to have the preference, reserving the hot bath for the more obstinate cases only. And the tepid or temperate bath is applicable to those cases that are more recent, and have been preceded by acute rheumatism, and which are accompanied by an increase of pain on becoming warm in bed.

The effects of a *cold bath* of common water, on a person in the ordinary state of health, commence with a general sensation of cold, which is almost immediately succeeded by a general sensation of warmth, the latter rapidly increasing, so as to cause the surrounding water to feel of an agreeable temperature. If the immersion have been sudden and momentary, and the body be immediately dried and covered from the air, the sensation of warmth continues, the whole body feels refreshed and invigorated, and under favourable circumstances, the natural perspiration is increased. But if the immersion be continued for a considerable time, and the water be not near the highest temperature of the cold bath, viz. about 65°, the sensation of warmth goes off, and is followed by numbness and shivering;

the skin becomes pale and contracted, the vessels near the surface are diminished in diameter, and of course a greater quantity of blood must be determined to the internal parts. The person feels drowsy and inactive; his joints become rigid and inflexible; his limbs are affected with pains and cramps; his breathing becomes quick and irregular; his pulse slow and small, yet for a time firm and regular; his perspiration is suppressed, and generally a copious discharge of urine takes place. If the immersion be still continued, or if the water be very cold, the pulse gradually ceases at the wrist; the action of the heart becomes weak and languid; a sensation of faintness and coldness at the stomach is experienced, followed by a rapid diminution of the whole animal heat. At length delirium and torpor come on, and the person is carried off by a fatal apoplexy.

In the above description, the patient is supposed to be suddenly plunged into the water. If the bather enter the bath slowly, the sensation of cold is more striking; a shivering is produced; and, as the person advances till immersed up to about the pit of the stomach, a shuddering and convulsive throbbing takes place, sometimes attended with sickness and head-ach.

When the cold bath is applied by affusion, that is, pouring the water on any particular part, or on the whole body, as in the *shower bath*, its effects are generally more sudden and more transient, though by repeated affusions they may be increased to any required extent. The degree of returning warmth, will depend on the circumstance of the body being freely exposed to the evaporating action of the air, or protected from it by proper clothing.

As it is the re-action of the system, which produces the sensation of heat from the use of the general cold bath in any form, and which also enables the body to derive advantage from its use, where this re-action of the system does not take place, or only in a small degree, the employment of the cold bath is not merely useless but injurious; but let it be observed, that this re-action is not likely to follow if the patient be chilly or cold by undressing, &c. before entering the bath. There is much danger in entering a cold bath with the body cooled, by any means, below its usual temperature, but no danger from being warm with walking or other exercise. When, after the use of the cold bath, a person feels chilly and inactive, it is evident that the bathing does not agree with him. The medical use of the cold bath, as connected with our present

inquiry, is as a general tonic remedy in various chronic diseases, in which there are languor and weakness of circulation, with profuse sweating and fatigue on very moderate exertion, tremors of the limbs, and many of those symptoms usually called nervous, the mind listless and indolent, but at the same time where no permanent morbid obstruction or visceral disease is present. Such a state of body is often the consequence of a long and debilitating sickness; or of a sedentary life, from not using the exercise requisite to keep up the activity of the bodily powers.* The general cold bath is inadmissible in all cases wherein the heat of the body is less than usual; wherein there is any unusual fulness of the blood vessels; and also in cases wherein the person is subject to inflammatory affections of the lungs, or a determination of blood to the head; and it is likewise seldom admissible in cases of indigestion induced by high living.

What has been said of the use of the common cold bath, applies in every respect to the use of Askern water at its natural temperature; but unless some particular advantage may be expected to accrue from the use of this mineral water, any one would prefer bathing in

* Saunders on Mineral Waters, page 499, &c.

common spring water, to immersion in a sulphureous mineral spring. Askern water is seldom, if at all, used as a general cold bath; but as patients may visit Askern with cutaneous diseases, admitting of relief by the external application of this water, and with a state of the general system in which cold bathing is directly useful, in such cases a cold bath of sulphureous water would be particularly valuable, and it is certainly worth the attention of the prosecutors of medical science to keep in mind, more particularly than it is usually done, both the effects of the temperature of the baths, and the effects of the external application of the water as respects its composition, and the alteration which its composition undergoes at different temperatures.

Cold water is in some cases applied to particular parts of the body, and retained there by the application of wet cloths, so as to keep the parts permanently cool. This mode of application of mineral waters is not uncommon, and may probably be found an useful method of using Askern water to circumscribed patches of cutaneous disease.

SECT. 5.—*Of the external and internal Application of Askern Water, used conjointly.*

Although the invalids who frequent Askern usually drink the water, this is considered, as was before observed, only of secondary importance, and the use of the water as a bath, generally warm or hot, is regarded as indispensably necessary; there are some cases in which this plan would be better reversed, and there may be some cases in which simply drinking the water would be the most eligible mode of using it. To enumerate any cases, as examples in which drinking the water has been found most efficacious, is impossible, because, as we have just mentioned, bathing is almost always used.

In drinking the water, the changes which its composition undergoes at different temperatures, and also the sensible effects produced on the patient's stomach, ought both to be taken into consideration. The water, at its ordinary temperature, contains the gases and salts as stated at the conclusion of Chap. II. viz. sulphuretted hydrogen, carbonic acid, oxygen, and nitrogen; and the salts are sulphates of lime and of magnesia, carbonates of lime and of

alumina, and muriates of lime and of magnesia. The higher the temperature of the water is raised, the less gaseous bodies it contains; and by elevating it to the boiling temperature, the whole or nearly the whole of the sulphuretted hydrogen and nitrogen will be expelled, and the matter which we have denominated resin of sulphur be formed.

The change in the state of the solid ingredients by heating the water, will be an increase in the proportion of the sulphates and muriates by the evaporation of the water, and a decrease in the proportion of the earthy carbonates from their precipitation, in consequence of the excess of carbonic acid being driven off.

By attending to these changes of composition arising from heating the water, and at the same time taking into consideration the effects of mere water at different temperatures on the human body, the employment of this and of other mineral water may perhaps be reduced to such certain principles, that the practitioner may be enabled to prescribe the water in that state, which shall insure it to contain in solution such ingredients of its composition as may be most conducive to the cure of any particular disease for which it may be administered.

In the external application of the water, though the temperature alone of the water has more direct influence than when used inter-

nally, yet the same reasoning will apply, particularly as the required temperature may be obtained two ways, viz. either by mixing hot and cold water together,* or by using hot water wholly, and allowing it to cool to a temperature suited to the case of the patient. By the former mode of graduating the temperature of the water, a considerable proportion of the gaseous bodies and of the carbonates is retained; by the latter, the resin of sulphur is formed, and the sulphates and muriates remain in solution, but the carbonates are precipitated, and of course, however small the effect may be which they produce on the surface of the body in a state of solution, they are now reduced to a state less capable of acting.

What the cases are, wherein warm bathing is indicated, and in which the water containing sulphuretted hydrogen is more efficacious than when containing resin of sulphur, I am ignorant, because unacquainted with sufficient facts from which to draw any certain conclusion. But because of our present ignorance let not investigation cease, rather let it proceed with additional vigour, and though its pace may be unequal, yet so long as it rests on the crutch of philosophical experience its advancement will be permanent.

* This method is the one generally practised at Askern.

CHAP. IV.

ON THE

MEDICINAL APPLICATION

OF

ASKERN WATER.

SECT. 1.—*Hints towards founding the Application of the Water on fixed principles.*

THE common method of using Askern water has been, bathing in it at an elevated temperature twice or thrice a week, and drinking it occasionally. If this method did not cure the patient, the water was usually considered as inefficacious; but, as has been shown in the last section of the preceding chapter, it is very probable that by *varying the mode* of heating the water, and by attending more particularly to the temperature of the bath, its effects may be rendered more certain, and its utility extended to a greater number of diseases. At present this precision can only be attempted, and for want of a sufficient number of facts,

some of the directions in the concluding section of this chapter may very likely turn out to be founded on erroneous principles; but as they are only offered as a substitute for the present arbitrary method of immersing patients of all habits and in almost all diseases in hot sulphureous water, if they occasion more circumspection in the use of the water, and a greater attention to the particular complaints which yield to any certain mode of its application, the end will be answered, and a real improvement will be the ultimate result.

If it were possible for the case of each individual to be registered,* and also the effects of the water in each, and the manner in which it had been used, sufficient data would, in a little time, be afforded from which to infer whether the use of the water in any given case would be efficacious, inert, or injurious. For such a record of cases to be really useful, it would be necessary for the complaints to be accurately discriminated, and recorded in *precise, appropriate, and unambiguous terms*.

In popular and fashionable watering places, where the water has been used for ages, the mode of application is even now almost as

* In Berginan's Essays, vol. III. is a register of above 500 cases, and the results of each after using the Lokarne mineral water.—This is the only published catalogue of any extent, that I have seen, of cases treated by a mineral water.

arbitrary as at Askern; to such, a similar method would be of the greatest use. Though there is no doubt that the many enlightened and judicious medical characters who have made these places their residence, have arrived at certain and valuable practical facts from their individual observation and experience, yet individual experience is nothing compared with what such collections of experiments would be, as is evinced by what the philanthropic and philosophical Heberden relates of a dispute,* between those who by their experience and sagacity were best qualified to decide concerning the efficacy of Bath waters in paralytic patients, “in which one side asserted that the paralytic patients were cured, and the other that they were killed by the use of these waters.”

SECT 2.—*General Directions during a Course of the Mineral Water.*

Be temperate in eating and drinking.

A diet composed of plain animal and vegetable food is the best.

* Heberden's Commentaries, chap. 13, page 72.

Spirits, wine, ale, and other fermented liquors should be used sparingly, and they who have been in the habit of indulging in such beverages, will generally find that by diminishing the usual quantity, the effects of a course of Askern water will be more directly and permanently beneficial. The most wholesome beverage at table is water. But as all the water at Askern is very hard, it is neither so pleasant to the taste, nor so well fitted for assisting the process of digestion as a purer water would be. To remedy this inconvenience, the inns ought to be provided with an apparatus for distilling the water,* and indeed if a steam apparatus be employed in cooking, the addition of a condensing tub and spiral tube is all that would be required for the purpose.

A little wine after dinner is not in general injurious, and to spare and weakly habits, when unaccompanied by any inflammation or predisposition to such a state in the lungs or liver or other internal organs, is of real use. To plethoric or full habits wine is improper, though every one must have observed that such

* When the hardness of water arises from lime held in solution by carbonic acid, boiling the water, and then allowing it to cool, removes the impurity; but as sulphate of lime (vide p. 4 and 23) is also present in the water used at Askern for domestic purposes, this method would not answer, and filtering would be still less effectual.

generally indulge in it the most; but, as has been remarked by an eminent physician,* “though the strong and robust may enjoy the pleasures of the table and the bottle with *seeming* impunity, and sometimes for many years will not find any bad effects from them, yet, depend upon it, if a full diet of animal food be every day indulged in, with only a moderate portion of wine after it, its baneful influence will at last blast the vigour, and sap the foundations of the strongest constitution.”

Late hours must be avoided. Early rising is always conducive to health, and if to some debilitated habits this makes the day too long, let such lay down for an hour during the heat of the day.

Exercise ought to be taken to an extent sufficient to make rest pleasant, but too much fatigue must be avoided; walking is the best exercise, except when from lameness or debility the patient cannot enjoy this, or wishes for a greater range of scenery, then riding is preferable, and indeed it can be so managed as to be either very active exercise or almost passive motion, for when a person rides slow on

* Dr. Garnett.

an easy horse, he may, to use the quaint language of Fuller, "be said to be exercised, rather than to exercise himself."*

Dancing, as exercise merely, is too violent for many weakly habits, though it often happens that persons who complain of inability to walk during an hour, will dance three or four. For dancing to become subservient to health, it ought neither to be used late in the evening, nor in a room either crowded or close, or illuminated by a number of lights.

Sedentary amusements of all sorts, as cards, backgammon, chess, &c. are so apt to interfere with the time which should be dedicated to active exercise, that if allowed at all, the patient should jealously watch lest they shorten or prevent the evening walk or morning ride.

Either neglecting to take sufficient exercise, or indulging too much in the gratifications of the table, will often prevent all the good effects which a course of the mineral water might produce.

The mineral water may be drunk at any time, but before breakfast is certainly preferable, and the dose may be repeated in the

* *Medicina Gymnastica*, 1705.

forenoon. It is best to drink the water cold, but if it feel to load or produce any unpleasant sensation at the stomach, let it *be mixed* with a little of the heated mineral water, and let each dose be taken rather cooler than the former, till the stomach will bear it of the natural temperature. The flavour which the sulphuretted hydrogen leaves in the mouth, and the fetid eructations which often occur afterwards, are best corrected by chewing a little biscuit. The dose of the water ought not to be less than half a wine pint, but they whose stomachs will bear it may take double or treble this quantity, and repeat it twice or thrice a day. When the water is intended to produce a purgative effect, from a tea spoonful to a table spoonful of pure and dry Epsom salt* may be added to half a pint of the water.

No good can be expected from drinking the mineral water at the meals, or directly after them, as is sometimes practised.

Bathing may be used at any time of the day, except immediately after meals; but in such complaints as from pain or general uneasiness prevent sleep, the evening is the better

* Epsom salt, or sulphate of magnesia, is incompatible with none of the constituents of Askern water except muriate of lime, and perhaps not with so small a quantity as that which the water contains, viz. $\frac{19}{100}$ of a grain in four pints of the water.

time for bathing, and a light supper may be taken afterwards. After using either the warm or hot bath it is in most cases injurious to encourage sweating, for though a certain degree of perspiration is beneficial in many complaints, yet this commonly follows the use of the warm and hot bath, without being induced by any unusual quantity of clothing, and when the bath is employed in the evening there is generally a gentle perspiration during the night. The frequency of repeating the bathing, depends much on the patient's feelings; if he feel his complaints abated, more lightsome, and no chilliness, head-ach, or sensation of weakness, he may bathe every other day, then two days and miss one, and in some cases bathing every day may be used. Patients ought to attend particularly to the temperature of the water directed in different circumstances and cases in the following section, and to the difference of baths, as explained at p. 79, &c. As judging of the temperature of water by the sensation of heat impressed on the hand is extremely fallacious, no invalid ought ever to step into a bath till the temperature about midway between the surface and bottom of the water has been ascertained by the thermometer.

SECT. 3.—*Directions applicable to particular Diseases.*

Invalids flock with diseases of various and contradictory natures to popular mineral waters, and in almost a mechanical way all use the same medicine in the same manner; thus a sort of empiricism is established, similar to that which accompanies the use of quack medicines, and very likely in both instances the consequences are—that some receive no benefit, many are cured, but more killed or have their diseases aggravated. In the following pages will be found some diseases or complaints in which Askern water has been found beneficial, some in which it may perhaps be found useful, and others in which its efficacy is doubtful. If all chronic diseases could be arranged with precision in two classes, the one in which the water is beneficial, and the other in which it is inefficacious, we should have arrived at a greater degree of practical knowledge than has yet been attained of any mineral water. But alas, we must here deplore our ignorance, instead of boasting of our knowledge; and this will be the case as long as

medical opinions are formed from preconceived notions, and general inferences drawn from particular facts, in place of resting on careful observation and aggregated cases.—Nothing that is connected with medicine tends more to perpetuate error, and blend it with truth so completely that they cannot be distinguished, than the boasting of virtues which do not exist, and the celebrating remedies for cures they have never performed;* yet this is the practice at all watering places, and though it is probably done with an intention of raising the respective waters in the estimation of the public, yet, so far from answering this purpose, it tends to bring them all to the same standard.

The waters of Malvern, of the sea, of Cheltenham, of Harrogate, are all celebrated for the cure of cutaneous eruptions,† though the first is so pure that it contains little or no foreign ingredients, the second abounds in common salt, the third contains a little purg-
ing salt and some oxide of iron, with traces of

* Dr. Saunders informs us, that during a short stay at Cheltenham, in 1802, he perceived the waters were used indiscriminately in a variety of opposite cases, and concludes that “one-third of the whole was benefited, one-third derived no advantage, and another third was evidently hurt.”

† Pages 109, 231, 297, and 415, of Dr. S.’s treatise.—Dr. S.’s report must of course have been taken from the popular celebrity of the waters.

sulphuretted hydrogen, and the last is decidedly sulphureous, and abounds in purging salts. From seeing waters so different in composition celebrated in the same diseases, it strikes one at first that all their efficacy must depend on the mere watery liquid, it being the only circumstance in which they agree; but it is more probable that this seeming similarity in effect, is from the *particular cutaneous diseases*, in which they are respectively useful, either not being properly determined, or accurately discriminated.

Askern water is celebrated for curing scrofulous ulcers and swellings, gout and rheumatism, paralysis, complaints of the stomach or organs of digestion, consumption, and cutaneous diseases or scorbutic complaints, all of which will come under our consideration.

The directions given for using the water, will be founded on facts where they have been afforded;* but as comparatively few have been preserved, the knowledge of the composition of this water, the changes it undergoes at different temperatures, and analogy, must at present supply the deficiency; but as the directions are professedly to invalids, and intended to be plain, they must necessarily

* Pages 94 and 95.

appear in somewhat of a dictatorial dress, and be divested, as much as is consistent with precision, of technical phrases. It is the manner how, not the reason why, that patients more especially require.

Scrophulous ulcers and swellings, when they occur to a considerable extent or are of long standing, are usually called *the evil*, a complaint for which hundreds of remedies have been celebrated, yet it still very seldom admits of a cure, though sometimes its virulence seems to be exhausted before the patient's constitution is destroyed. Among other waters Askern has come in for its share of celebrity, and whether it is superior, equal, or inferior in efficacy to others, I know not, but presume it is equal to any other sulphureous water, and to elicit its medicinal powers the following mode may be followed.

Drink a glass of the water every morning, and if it induce costiveness, or do not gently open the bowels, a tea spoonful of Epsom salt may be dissolved in it two or three times a week, and the quantity of the salt increased or diminished according to the effect produced. If there are sores, let them be washed with the water three times a day, and folded linen rags wet with the same kept applied to them. To scrophulous swellings the same mode of

treatment is proper, and unless the swellings are painful to the touch, they may be rubbed for five minutes with the hand at each time of dressing.

Bathing every other morning may be employed. If the patient be not much debilitated, the temperate bath may be used, and the tumified parts well rubbed during immersion. If the patient's health improve, and neither cough nor pain in the breast are present, after the tepid bath has been employed several times, its temperature may be gradually lowered till converted into the cold bath, but it must be observed, that the colder the bath is, the less time must the immersion continue; and that a sensation of cold or chilliness occurring while in the water, or soon after coming out, is a proof that either the water has been too cold, or the patient has been too long immersed.

If the patient be much emaciated, or have a cough or pain at the breast, then the warm bath must be used, which ought to produce, after the first effect of immersion ceases, a pleasant feeling of a moderate and natural temperature. The precise time of immersion is difficult to specify; it ought to be till a gentle perspiration takes place on the head and face, and unless some unpleasant sensation occur, the time may be from five to twenty

minutes, beginning with a short time and increasing it gradually, and according to the effects experienced. If a sensation of weakness directly follow the use of the warm bath, it proves that the bather has been too long immersed.

The diet of scrophulous patients ought to be light and nutritious, of which plain animal food must form a good proportion, and milk should be used for breakfast, instead of tea and other diluting beverages. If the patient do not complain of internal pains, and appear of a cold languid habit of body, a small quantity of any generous wine and a biscuit may be taken twice a day, between meals.

In using Askern water in scrophulous swellings, &c. no good can be expected to accrue unless it be persevered in for a long time. The course of these complaints, even when most favourable, is slow, and it appears that it is only from the continued action of appropriate means on the constitution that a cure can be expected.

Gout and Rheumatism, though they may be specifically different in their nature and origin, yet in the state and stages in which patients afflicted with them generally resort to watering places, they admit of nearly the same mode of treatment.

In rigidity of the joints, and pains of long continuance, the warm bath should be employed, gradually increasing both the frequency of its repetition, and also its temperature.

At the commencement of the course the temperature may be about 95° , and if the complaints do not yield, it may be increased till it comes under the range of the hot bath, which, at the temperature of 105° , is often very efficacious. In using the hot bath, which should not be resorted to till the warm bath is found ineffectual, much caution must be exercised, and at all times it must be entered a few degrees below the point which the patient intends to employ, and after immersion for a short time, more hot water added to produce the intended temperature. If during immersion either difficulty of breathing, or pain or anxiety at the breast, and violent throbbings in the head come on, the patient must attend to these, they being unequivocal signs of his staying too long in the bath. To remain after these warnings might be of fatal consequence.

In rheumatic pains that remain after recent attacks of acute rheumatism, and cases in which the pain is aggravated on becoming warm in bed, the temperate bath should be employed, commencing at about 82° , and if

the painful symptoms subside, and there are no contractions of the limbs or rigidity of the joints, the cold bath may be ultimately resorted to,* commencing with a momentary immersion, and when a glowing warmth succeeds the use of it, and no headach follows, it may be persevered in for some time, increasing both the frequency of its use, and the length of the time of immersion, which, however, should never be protracted till chilliness comes on. But if the painful symptoms do not subside from using the tepid bath, its temperature must be increased till it comes under the range of the warm bath, and the same cautions and directions attended to as in the preceding paragraph.

The time of the day when bathing is used is not of material consequence, except when the pains are aggravated at night, and then evening is the most eligible time; and when the cold bath is employed, the forenoon is most advisable, and exercise should be taken immediately afterwards.

In all the varieties of gouty and rheumatic affections that resort to Askern, frictions with

* A commodious cold bath is much wanted, water might be supplied from the pool, and easily obtained from the immediate scite of one of the many sulphureous springs. If a bath or a suite of reservoirs were formed, and thus supplied, the utility of the mineral water might be much increased.

the flesh brush or the hand are particularly useful, and ought to be performed by an attendant, as the patient cannot persevere sufficiently long at a time; which ought never to be less than six minutes, and repeated two or three times a day; and the friction will be more serviceable when performed during immersion, in cases wherein the warm or hot bath is used, and before immersion, in cases wherein the temperate bath is employed.

Gouty and rheumatic patients must drink the water in the usual manner, adding Epsom salt occasionally, so as to keep the bowels in a slightly laxative state; and if any weight at the stomach, heartburn, or other symptoms of indigestion occur, and particularly if the patient be robust and plethoric, the quantity of the salt must be increased, so as to produce full purging twice a week. Regular exercise must be taken, avoiding exposure to a cold damp atmosphere, without sufficient warm clothing; and though a person is not particularly liable to take cold during the use of the warm bath, yet to invalids suffering under the complaints in question, flannel or fleecy hosiery next the skin, and thick warm shoes, are indispensably necessary. When flannel can be applied in the form of a bandage rolled tight round the affected part, its utility is much increased, and the relief it gives is sometimes

instantaneous. A temperate and warm bath of Askern water is generally formed by mixing heated and cold water together, but perhaps it may be found more efficacious in rheumatic cases, when formed by allowing hot water to cool to the proper temperature.

In pains of the head, that sometimes affect gouty and rheumatic persons, and which are occasionally aggravated by using the tepid and warm bath, and occur on the cessation of the pains in the extremities, effectual relief has been obtained by intermitting the general bath, and using the shower bath during the intermission; but this treatment has only been tried in, and perhaps is only applicable to, cases arising from recent attacks of acute rheumatism.

Palsy or Paralysis,—this disease, like the former one we have mentioned, is so distinctly marked in that stage of it in which patients visit watering places, that a description of its general features will be sufficient. Usually an attack of palsy commences by part of the body being suddenly deprived of sensation and motion, and such an attack constitutes what in popular language is called a paralytic stroke, and is sometimes simultaneous with an apoplectic fit. But sometimes palsy attacks more gradually, or if there be any sudden fit

it is indistinctly marked, and yet, from the complaining of tingling in different parts of the body, the difficulty in articulating words frequently in use, and general tottering of the limbs, particularly of the knees, the presence of a paralytic affection is sufficiently evident. The shaking hand, which most people must have observed as generally occurring in cases of premature old age induced by intemperance, is a symptom usually called nervous, though nearly allied to palsy, and the same symptom also frequently occurs in old persons who have allowed life's thread to be fairly spun out. Palsy, though generally a disease of declining life, occasionally attacks children and young persons, and is also often induced from exposure to metallic or mineral emanations, hence miners, plumbers, painters, and especially manufacturers engaged in any business where lead in any state is employed, are subject to paralytic affections; and in palsy arising from this cause, Askern water will probably be found particularly beneficial.

In using the Askern water, the same directions are applicable as are given for employing the warm and hot bath and for drinking the water in rheumatism, but the friction must be employed for a longer time, and the general cold and tepid baths are in all cases inapplicable. Similar cautions are also necessary, as

in the above disease, and particularly when after finding the warm bath ineffectual the hot bath is used, its effects must be carefully watched; and if, from a sensation of fulness or beating in the head, or from the veins about the neck and face appearing particularly distinct, there is reason to fear a redundancy of blood in the head, threatening apoplexy, the patient must take a larger quantity of Epsom salt in his daily dose of the water, and stay in the bath a less time, or leave it off altogether for a time, and use dry pumping as it is generally called, that is, pumping the water so as to fall in a stream on the affected limb.* When dry pumping is used in palsy, the water ought to be of a temperature equal to that of the hot bath, viz. about 105° or 110° , and the number of strokes commenced with may be fifty, and gradually increased.

In paralytic patients, the general directions as to regimen, at page 99, may be attended to, and persons who have a pale countenance, and whose general appearance is that of a spare habit, may with propriety take a daily portion

* If there be not as yet any arrangement made at Askern for this process, pumps could easily be attached to the bathing tubs, and the water obtained of any temperature; and if the pumps were made on the principle of the forcing pumps used to water fruit trees, &c. the impetus of the stream could be increased at pleasure, so as it were to combine the effects of friction or percussion with the operation of the heated fluid.

of wine, or a little brandy and water; but they who have short necks, large heads, red or purplish faces, who are corpulent, and have prior to their paralytic attack lived in an indolent manner, have indulged in intoxicating liquors and a full diet of animal food, that is, lived well, as the common expression is, must carefully abstain from, and in many points reverse, their former habits.

Complaints of the Organs of Digestion are so numerous, and possess such a train of seemingly contradictory symptoms, that in many cases it is difficult for even an acute and experienced physician to distinguish the incidental from the essential symptoms, and detect the particular seat and real nature of the disease under consideration; and, therefore, to attempt to lay down rules by which unprofessional readers could ascertain with precision the nature of their own complaints, when the digestive organs are affected, would be vain and even absurd, and especially as one of the characteristics of such affections is, that the patient is apt to attach the greatest importance to trivial and sometimes to imaginary symptoms.

The complaints of the digestive organs to which these directions are intended to apply, are indigestion or dyspepsia, and that indefinite posse of complaints called, in general

terms, bilious and nervous,* which are frequently symptomatic of either impaired or diseased action of the stomach and its assistant viscera. As persons labouring under complaints of the digestive organs have generally employed some medical practitioner before they look to mineral waters for relief, and the general nature of their complaints has of course been ascertained, it is a safe presumption, that when an invalid comes to Askern for what he supposes to be indigestion or a bilious complaint, that his supposition is correct, particularly as such complaints are so common as to be often mistaken for other diseases by the patient, and sometimes by the medical adviser, but other complaints are not often mistaken for them. But that some guide may be afforded to patients who doubt the nature of their complaints, let it be observed that there can be no doubt of some of the digestive organs being the seat of the disease, when all or most of the following symptoms occur at one time,† viz. want of appetite, sickness or vomiting, flatulency, sour eructations,

* Dyspepsia and hypochondriasis are arranged in the class Neurosis of Cullen, and involve as symptoms most of the complaints which are in general language called nervous.

† These symptoms are almost a literal translation of the definition of dyspepsia, as given by Dr. Cullen in his *Synopsis Nosologiæ Methodicæ*, 1802, p. 280.

rumbling of the bowels, heart-burn, pain or gnawing at the stomach, lowness of spirits, disturbed sleep, and in general costiveness.

The treatment as connected with a course of Askern water is—to drink the water as directed at page 101; to use a temperate bath of about 82°* every third morning, and then every other morning; and to follow the general directions relative to diet, air, and exercise, given at page 99, being particularly attentive to rising early, to the use of pure water as the common beverage at meals, and to keeping the bowels in a regular or rather a relaxed state, which is both a part of the method of cure, and also a proof, when this state continues without much artificial aid, that the digestive organs are regaining their natural tone.

Consumption of the Lungs,—of this there are several kinds, according to the divisions of different writers, but as their distinctions are usually derived from the proximate causes or peculiar kind of diseased action in the lungs, which it cannot be supposed that persons unacquainted with the anatomical structure and physiological powers of the human body can either investigate or discover in individual instances, to detail the description of each

* Chap. III. sect. 3, p. 79, and sect. 4, p. 86.

species or variety would be superfluous. The symptoms that invariably attend pulmonary consumption in all the species are, wasting of the body and cough, which varies in different varieties of the complaint, from a short dry cough to a violent cough with considerable expectoration; pain in the chest, which in some instances is acute, momentary, and varying in situation, in others more permanent, and in some again a fixed and, allowing the expression, a weighty pain; and accessions of fever frequently recur, though at first so slight as often to escape notice.

When these symptoms of wasting of the body, cough, and pain in the chest occur at the same time, there is always reason to fear consumption, and particularly if accompanied with febrile heat or flushing of the face, and no doubt but many thousands die annually by their fears respecting the nature of their complaint not being sufficiently awakened; for from the time of life at which it generally attacks, being, as it were, the spring and bloom of maturity, when all the vital powers are about to become fully expanded, and hilarity and gaiety enliven and deck every function; and from the delusive hopes which this insidious disease gives by the frequent partial returns to health during its progress, the danger is often not perceived either by the

patient or friends till the lungs have sustained irremediable injury.

In this disease, where so many medicines have been cried up as specifics, and such various modes of treatment been considered as efficacious, yet after a time have only been ranked as inefficient remedies, it would be absurd to pretend that Askern water would cure consumption, but I have witnessed its efficacy in in retarding the progress of this disease in its worst forms, and therefore can recommend it as a powerful auxiliary ; but further experience is required to shew how far its beneficial powers may extend. Dr. Duncan, in his valuable observations on pulmonary consumption, mentions sulphureous waters as having been strongly recommended even in the confirmed stages of tuberculous consumption, and says, "But after it is distinctly marked, although in some respects they may seem to be indicated, yet in others their operation is unfavourable, particularly if taken to such an extent as to produce a purgative effect."* The particular objection which the Doctor here makes to their use, does not apply to the Askern mineral water, as it very rarely produces any purgative effects ; therefore, if any sulphureous

* Observations on pulmonary Consumption, by A. Duncan, sen. M. D. 1813, p. 121.

water be more worthy of trial in this destructive disease than another, it is the water in question, which differs from the popular sulphureous waters of this kingdom in not containing purgative salts, and in affording the peculiar substance resembling the resin of sulphur of Westrumb.

Consumptive patients visiting Askern must drink the water* and use the warm bath,† heated in the common manner. In using the warm bath for this disease, its temperature should be about 94°, or such that the patient distinctly feels the skin impressed with a warm sensation, which after the first impression leaves a pleasant feeling of a natural temperature. After coming out of the bath and dressing, exercise may be taken, but not such as to produce fatigue; but if the bath be used in the evening, care must be taken lest excessive sweating occur in the night.

The time of remaining in the bath may be increased gradually, and though it may be employed safely either during the presence of the hot stage of the febrile attacks, or during the sensation of partial cold or chilliness, yet in the latter state its use will perhaps be most advantageous. If the bathing agree with the

* See page 101.

† Pages 79 and 84.

patient, the heat of the skin will be lessened, the pulse become slower, the cough and pains in the chest less violent, the sleep more refreshing, the spirits exhilarated, and the strength and aptitude for exertion on the whole increased.

To consumptive patients, their diet is of the greatest importance, and in the management of it the most serious errors are often committed. From the patients being weak and emaciated, it is often presumed that strong stimulant diet is indicated, and hence the pernicious practice of drinking rum and milk in a morning, and wine and cordials at other times, which so generally prevails, a practice which can do no good, and which generally aggravates the painful symptoms of the complaint, and rapidly accelerates its fatal conclusion. The diet ought to be nutritious but not heating, therefore spirits and all fermented liquors must be avoided, and a diet of innutritious substances, as tea, toast and water, &c. is almost equally injurious; but milk, eggs, rice, jellies, broth, sago, arrow root, &c. also the common culinary vegetables, and in the generality of cases a moderate proportion of plainly cooked fresh animal food is proper, and likewise fruit, unless it disorder the bowels. These will afford variety sufficient even for

capricious stomachs, and take off that dis-relish for the diet prescribed, which the confinement to two or three articles often induces.

The short directions at page 100, relative to air and exercise, are applicable to consumptive patients, and the exercise of swinging, by sitting in a chair suspended by ropes, has been particularly recommended ;* and as it may be employed either within doors or in the open air, requires but little muscular exertion, and produces a refreshing current of air in close and sultry weather, or when from rain, taking other exercise would be improper, it well deserves the attention of the invalid.

Cutaneous Diseases or Scorbutic Complaints.
In popular language, all eruptions of the skin of long continuance, or that repeatedly attack the same individual, are called scorbutic, and various ulcers of the legs are also designated by the same appellation ; thus a multitude of diseases, dissimilar in their origins, appearances, and consequences, are associated together under one word, and become ideally considered as but one disease in different forms. If incorrectness of expression were the only evil that the misapplication of the terms

* Dr. Carmichael Smyth considers swinging as superior to all other modes of gestation in phthisis,

scurvy or *scorbutic* occasioned, it would be of little consequence, but from calling almost all chronic affections of the skin scorbutic, when a person is said to be cured of scurvy by any particular medicine or mode of treatment, all that hear of it or are affected with scorbutic disorders, (to use the common expression) resort to the same, though perhaps what has effected a cure in the disease of the skin of the one, may in the other cases aggravate the complaint.

Scurvy (according to the classification of diseases by the late celebrated Dr. Cullen,* which is very generally used,) is a term solely applicable to a peculiar disease whose attacks are almost entirely confined to sailors during a long voyage, and when living on salted and putrid food. Scurvy, since the time of Capt. Cook, has become comparatively rare even among seamen; therefore if the term be only used in this limited manner, it must exclude nearly all the eruptions that are generally designated as scorbutic.

By some medical writers a disease† has been described under the name of land scurvy, from its resemblance to the above, but even this

* Scorbutus. Genus. 85.—Cull. Genera. Morborum.

† Purpura hæmorrhagica of Willan.—Bateman's Synopsis, 3d edition, p. 105.

disease, admitting the propriety of the term, is of so rare occurrence, that perhaps not a dozen cases occur annually in the whole county of York. From this indeterminate and inapposite application of the term scurvy, as employed in popular language, when treating of different diseases of the skin in the following pages, some characters will be given descriptive of the particular affections enumerated; and *chronic cutaneous diseases*, or *diseases of the skin*, will be substituted for the popular and misleading expression, *scurvy* or *scorbutic complaints*.

Askern water has been much celebrated for curing chronic diseases of the skin, but from the confusion in which these complaints have been long involved, it is very difficult to say the precise kinds that have been most benefited. Even among professional men, the nature of cutaneous diseases has been but little attended to; and it is only within a few years that any work* has been published in the

* A practical Synopsis of Cutaneous Diseases, according to the arrangement of Dr. Willan, by T. Bateman, M.D. F.L.S. 1813.—An attempt was made by the late Mr. Benjamin Bell, to free some of the diseases of the skin from the obscurity in which they were enveloped, and arrange them under the generic term Herpes, of which he describes and distinguishes four species. Vide System of Surgery, vol. II.—Dr. Garnett, in his treatise on Harrogate water, adopts Mr. Bell's arrangement, regrets that eruptions of the

English language, which treats of cutaneous diseases with precision sufficient for the purpose of distinguishing the species that require different modes of treatment:

The cutaneous eruptions which, as far as respects the application of Askern water, are about to be noticed in as concise a manner as is consistent with perspicuity, are those that most frequently occur, the intention being that invalids may be able in the generality of cases to identify their complaints, and that correct information may be obtained respecting what are the particular diseases in which the water is most beneficial. The complaints will be enumerated according to their general similitude,* as thus, by bringing diseases nearly similar in appearance under view at the same time, the points in which they differ, as well as characters in which they agree, become more obvious, and consequently the particular diseases more easily ascertained.

skin should have been so little understood, and expresses his surprise that even some medical practitioners should confound herpetic with scorbutic eruptions. Vide Treatise on the Mineral Water of Harrogate, p. 112, 113.

* The arranging of cutaneous diseases according to their general similitude, a method well adapted for popular use, is suggested by Marshall Hall, M. D. &c. in the 13th volume of the Edinburgh Medical Journal, p. 189.

1. **LICHEN.*** This disease consists of a general eruption of small pimples, redder than the surrounding skin, and accompanied with a pricking or tingling sensation, the appearance of the eruption being preceded by a few days febrile affection, and terminating in scurf in two or three weeks from the appearance of the eruption. The pimples on the face are somewhat larger than those on the other parts of the body, which do not exceed the size of millet seeds, and on the hand the pimples sometimes assume the form of minute vesicles. There are several varieties of this complaint, but all agree with the above short description, and it is only when successive crops or eruptions of pimples occur, thus prolonging the complaint many weeks or even months, that the patient is likely to apply to a watering place for relief.

2. **PRURIGO, *Itching*.** This is an eruption of minute pimples, not easily perceptible from being the same colour as the skin. The pimples are accompanied with severe itching,

* For the sake of precision, the systematic names of Willan or Bateman are necessarily employed, but the popular names, where such exist, are added as expletives, though from the loose manner in which they are generally employed, their meaning is often very obscure. The references apply to the third edition of Dr. Bateman's work.

and from the tops of the pimples being scratched off, the skin appears studded with very small black or very dark brown scabs. There are several varieties of prurigo, the most mild affects young persons, and by cleanliness, warm bathing, and sometimes the internal use of sulphur, soon disappears; but the variety that occurs in advanced age,* and attacks persons addicted to the intemperate use of spirituous or fermented liquors, is a very obstinate disease, and the patient's distress is often extremely aggravated by the skin becoming infested with animalcules.

Prurigo is distinguished from lichen by the pimples of the former being of the colour of the skin, the absence of febrile affection at the commencement, and of scurf when the pimples decline.

3. SCABIES, *the Itch*, is an eruption of vesicles and pustules† intermixed, or in irregular succession, contagious, and accompanied with extreme itching, affecting particularly

* *Prurigo senilis* of Willan.

† Pustule, vesicle, pimple, &c. are terms to which in medical language precise and defined meanings are attached.—A pustule is a small elevation of the skin containing matter, with an inflamed base. A vesicle is a small elevation of the cuticle, containing a transparent or milky fluid, particularly at the top, and in common language is called *a watery pimple*. A pimple is a small conical elevation of the skin, with an inflamed base, not containing a fluid.

the wrists, between the fingers, and the flexures of the joints. This disease is often confounded with prurigo, and also with lichen. It varies much in inveteracy, and in its general appearance; in some cases, there are no pustules till the complaint has continued some time, in others the first appearance is pustular; the pustules are in some cases not larger than a mustard seed; of these varieties, *watery* and *pocky itch*, as they are called, are well marked instances, the one commencing with an eruption of semi-transparent vesicles,* the other commencing with distinct, prominent, yellow pustules, and obtains its name from somewhat resembling small pox.

The presence of pustules distinguish itch from prurigo and lichen, and where pustules are not very evident, it may be distinguished from prurigo by the vesicles abraded with scratching affording in itch a yellowish brown scab, often with matter under it, but in prurigo a minute blackish brown scab; and from lichen by the eruption being composed of pimples, but in itch of vesicles.

Persons that have applied to Askern, labouring under the above complaints, bear general

* Minute vesicles may be mistaken for pimples, but by puncturing them with a needle their nature is at once known, as a watery fluid exudes.

testimony of its efficacy, however some cases have resisted its power, but what the peculiarity of these cases have been cannot yet be ascertained, as the characters of the eruptions had not been accurately determined. For the cure of these diseases, warm bathing, washing the hands frequently in the water cold, and a plentiful use of the water internally, so as to produce a relaxed state of the bowels, are the means to be employed. The diet must be nutritive and plain.

4. IMPETIGO, *Running Tetter*, is an eruption of small pustules, either diffused over the body or congregated in clusters. The pustules break in a few days, then scabs are formed, and these fall off in two or three weeks from the first appearance of the eruption, and unless a fresh attack commences the disease terminates; but often repeated attacks follow, at uncertain intervals of from one to six weeks. When this disease exists in the diffusive form,* it is liable to be mistaken for the variety of scabies called pocky itch; but the circumstances of impetigo not being contagious, the itching being accompanied with much smarting pain, and the pustules after breaking forming dry scabs which separate and leave

* *Impetigo sparsa* of Bateman.

the skin red and chopped, afford characters sufficiently distinctive.

As this complaint sometimes resists all methods of treatment, both internal and external, in cases that resist the ordinary mode, it would be desirable to ascertain the effect of Askern water heated to the boiling point, and then cooled down to the temperature of the warm bath, thus exposing the body to a bath containing resin of sulphur.*

The general directions in Chap. IV. respecting regimen, are applicable to this complaint.

5. **PSORIASIS**, *Scaly Tetter*, appears in the form of chopped scaly† patches on different parts of the body. These patches are somewhat elevated above the surrounding skin, and produce scales which are separating continually, and in some inveterate cases a fluid is discharged from the chops. The patches when large are few in number, and occur most fre-

* Dr. W. uses impetigo, scabies, lichen, &c. as generic terms, and of course what are mentioned above as varieties constitute species in his arrangement. Though by considering impetigo, &c. as species, we lose sight of genera, yet, as these pages are intended for general perusal, if by this our acquaintance with individual diseases is facilitated, we must rest satisfied with thus sacrificing at the shrine of utility.

† *Scales* are layers of dry morbid skin, *scurf* is irregularly disposed bran-like particles, and *scabs* are concretions of fluids discharged from the skin.

quently on the fore arm and back of the hand ; when small, they are more numerous, and occasionally appear sprinkled all over the body,* in patches not exceeding the size of a sixpence. In one singular and more rare variety of the disease, they are in serpentine or contorted forms,† resembling in outline the shape assumed by an apple paring, on being carelessly thrown on the floor.

The absence of pustules, and the constant formation of scales, distinguish psoriasis or *scaly tetter*, from impetigo or *running tetter*. The mode of treatment is the same as in impetigo, and like it some cases are found to resist for a long time all applications, but, as in many other cutaneous diseases, the effects of Askern water on it are very imperfectly known, owing to the equalizing of these complaints, by considering all kinds of them and all gradations of inveteracy as scurvy. The employment of a vapour bath of Askern water seems to be indicated both in this disease and also in the following one.

6. LEPRA, of Greek authors, or *Leprosy*, is an eruption of smooth circular scaly patches, with elevated borders, often accompanied with soreness and a tingling sensation, and dis-

* Psoriasis *guttata* of Willan. † Psoriasis *gyrata* of Willan.

tributed over the body. It varies much in inveteracy and the size of the patches, but as they always retain their smoothness and circular shape, they are easily distinguished from the chopped and irregular shaped patches of psoriasis. It may admit of a similar mode of treatment with psoriasis, but is in this part of England a more rare disease, though, according to Bateman, common in the metropolis.* I have not witnessed the effects of Askern water in any cases of this disease, therefore know not how far it may be useful.

The disease which was so common in Europe about the thirteenth century, and which is now almost unknown in Britain, (for which so many spittles, hospitals, or Lazarettoes, houses dedicated to Lazarus, a saint of the popish calendar, were erected) was elephantiasis or *dal fil*† of the Arabians, which is literally elephant disease. The leprosy of the Jews‡ differs both from lepra and elephantiasis.

7. PITYRIASIS, *Scurfiness*, consists of a formation of scurf or small scales on different parts of the body, unaccompanied by swelling, discharge, or chopping of the skin. The

* Bateman's Synopsis, p. 28.

† Bateman's Synopsis, p. 311, on the authority of Mr. J. M. Good.

‡ Leviticus, chap. 14.

variety of this complaint for which medical advice is most often solicited, is that which attacks the head of adults about or after the meridian of life, and also of infants, in whom it is called *dandriff*.

Pityriasis is not liable to be mistaken for any of the diseases we have mentioned above, except psoriasis, which in some instances it resembles. The fissures or chops in the skin which occur in psoriasis, but are absent in pityriasis, afford a distinguishing character.

When pityriasis attacks the scalp, it may be mistaken for the complaint of the scalp called porrigo, scalled head, &c. but the knowledge of the former consisting of dry scurf or scales, and of the latter being invariably accompanied with discharge and scabbing, will prevent the two diseases from being confounded.

In this troublesome complaint, the treatment consists in warm bathing and the internal use of Askern water; along with washing the head twice a day with the water, after being boiled and allowed to cool to a warm temperature.

There is a variety of this complaint remarkable for the brown or yellowish discolourations with slight scurfiness of the skin, which it forms on different parts of the body, but principally about the breast and shoulders, but as little or no inconvenience attends this

form of the disease, little attention has been paid to its medical treatment, a course of Askern water used as above might perhaps be effectual.

8. PORRIGO, including *Milk Blotch*, and *Scalped Head*, is a contagious disease, and consists of small pustules on the scalp, forehead, and cheeks, which break and exude a viscid matter that concretes into scabs, under which the secretion of matter usually continues. There are several varieties of this disease, of which that which attacks the face of infants, and when inveterate forms scabs, which increase in thickness, and sometimes become confluent almost covering the face like a mask, is known to nurses by the name of milk blotch,* and when it does not yield to ordinary remedies, the external application of sulphureous mineral waters is recommended by high practical authority.†

The other varieties of porrigo affect the scalp, and are often very obstinate in resisting ordinary remedies, particularly that kind which breaks out in circular patches, from which it is denominated‡ *ringworm of the scalp*. All the varieties of porrigo are

* Crusta lactea of various authors. Porrigo larvalis of Bateman.

† Dr. Underwood.—Diseases of Children, 5th edition, vol. 1, page 83.

‡ Porrigo scutulata of Bateman.

complaints of childhood and early youth, except one* which attacks adults, and which, from the smallness of the scabs and the scurfy appearance of the head, is liable to be mistaken for pityriasis; but the presence of pustules in every variety of porrigo, will prevent the two diseases from being confounded.†

How far Askern water has been successful in the removal of the different varieties of porrigo, we have not the evidence of a sufficient number of cases to determine. When this mineral water is used, the hair must be kept close shaved, be washed with mild soap and soft warm water night and morning, and then bathed or fomented with the warm sulphureous water, and cloths moistened with the same applied frequently during the day. The water ought to be drank in the usual manner, and costiveness, if it occur, must be obviated by adding a little Epsom salt.

9. **SYCOSIS** is an eruption about the face, of smooth red tubercles or hard pimples, about the size of a pea, which suppurate very slowly,

* *Porrigo furfurosa* of Willan, edited by Dr. Smith, *furfurans* of Bateman.

† *Porrigo decalvans*, as described by Dr. Bateman at p. 173 of his Synopsis, is said to present "no appearance whatever, except patches of simple baldness, of a more or less circular form," and of course it cannot belong to the order *pustulae*, nor be either a species or variety of porrigo.

and discharge a thick glutinous matter. This disease attacks chiefly men, generally affecting only the part of the face where the beard grows, and by the soreness, matting of the hair, and concretion of the matter into scabs, renders shaving extremely difficult; but sometimes the eruption occupies the margin of the hairy scalp, and in this situation the discharge is thinner and more copious.

Of the cutaneous diseases noticed in the preceding pages, the only one for which this (and in the latter variety only) is likely to be mistaken, is *porrigo* or scalled head, from which it may be distinguished by the absence of pustules at its commencement, by its not being contagious, and by its attacking adults, whereas the varieties of scalled head with which it might be confounded are diseases of children.

The treatment of *sycosis*, during a residence at Askern, is the same as in the preceding disease (*porrigo*,) but the frequent application of moistened cloths during the day may be omitted, and the drinking of the water with Epsom salt dissolved in it must be more frequently repeated, at least twice a week, so as to produce full purging.

10. *ACNE, Spotted Face or Maggot Pimples*, is a complaint generally of so slight a nature as rarely to require medical treat-

ment, and the popular names so well define the affection that no further description is necessary. The black dots in the centres of some of the pimples, are the extremities of a vermi-form or maggot-like secretion of a yellowish colour, which is moulded into this shape by occupying the ducts of sebaceous glands, that are distributed about the nose, forehead, and chin. These maggot-like secretions are often extracted by applying the thumb nails on each side a pimple, and pressing with force sufficient to squeeze out the maggot as it is called ; but this mode of treatment, I think, often increases the diseased state of the skin and sebaceous glands.

Sometimes the pimples are very numerous, and either inflame and form no secretion, or else produce it very slowly, and from their numbers occasion a general redness of the nose and parts of the face which they infest. This obstinate variety of acne* attacks young persons, and often troubles them for years, though without being necessarily connected with any deranged state of the general system. In this obstinate form, it is often improperly denominated *scurvy in the face*.

The treatment consists of applying to the face cloths wet with the sulphureous water

* Acne indurata—Bateman.

warm, and retaining them in contact with the affected parts for some minutes, night and morning; and also washing the face every forenoon and afternoon with the water cold, and mixed with brandy, in the proportion of five table spoonful of the former to one of the latter. The warm bath must be employed twice a week, and the directions at page 99, respecting diet, &c. attended to.

The fiery redness of the face, and purple pimples on and about the nose, with enlargement of the veins of the skin, and granulated mulberry-like appearance about the nostrils,* so characteristic of habitual indulgence in wine and spirits, may be considered as a variety of acne, though it differs from the former varieties in its attacks being confined to persons of advanced life, and in being symptomatic, in nineteen cases out of twenty, of intemperate drinking, and therefore is as difficult to remove as the cause from which it originates.†

11. HERPES, *Tetters*. These names have been applied to various complaints of the skin, and have sometimes been used in such an extended sense as, like *scurvy*, to include almost every cutaneous eruption of long continuance; but

* *Acne rosacea*—Bateman. Bacchia of Sagar.

† It is supposed to be sometimes hereditary, and to attack individuals of temperate habits of life.

the disease which is now to be noticed, consists of an eruption, not contagious, generally preceded by fever, of clusters of vesicles on an inflamed base, and with a tingling or slightly itching sensation. The vesicles break in a few days, and ooze out a milky liquor, which dries into scabs, and the whole course of the complaint includes about twenty-one days, though often when the scabs separate long continued ulcerations ensue.

There are several varieties of this complaint, their principal difference arising from the parts of the body they attack, and the size of the vesicle.

Herpes of the Lips,* commonly called sore or scabbed lips, is a well known variety; and by comparing the progress of the complaint with the definition given above, the identity of sore lips with herpes will be at once perceived.

An herpetic eruption sometimes attacks the cheeks and forehead,† and occasionally the clusters of vesicles spread to different parts of the trunk and extremities, arising in succession for about a week, during which time the fever which preceded the eruption gradually abates, and ultimately the vesicles burst and produce yellowish scabs, which separate, leaving the

* *Herpes labialis*,

† *H. phlyctænodes*.

skin for a long time tender, inflamed, and irritable.

Shingles, or the Herpetetic Girdle,* is a form of herpes that arises in successive clusters of small vesicles, so as to form a zone round the body. This variety is provincially called *cat marles*; the meaning of the term I cannot explain, but the persons whom I have heard use it, have an idea that the complaint arises somehow or other from children playing with cats, though on inquiry it does not seem clear whether the name, which may be a corruption of some other expression, has not first given origin to this supposition. Shingles is also popularly, though erroneously, said to be fatal if it reach quite round the body.

The common *ringworm*† of children is a variety of herpes that occurs in the form of circular patches of minute vesicles; the vesicles dying or producing a very slight scabbing in the centre of the patches, and gradually extending the circumference to the size of a half-crown piece, by new vesicles appearing. Successive patches of these *herpetetic ringworms*, as they are called, arise in different parts of the bodies for several weeks, or sometimes months.

* *H. zoster*, of Bateman.

† *Herpes circinatus*.

By not attending to the definition of herpes the disease may be easily mistaken for other complaints. The eruption, when it attacks the cheeks and forehead, may be confounded with the porrigo called *milk blotch*; but the absence of pustules in herpes, and its not being confined to infants, and not forming prominent scabs, will guide the judgment in distinguishing the diseases. From the term *ringworm* being applied to insulated patches of cutaneous eruptions of very different natures, a source of confusion arises, as persons are apt to be guided by the similarity or sound of words, without allowing their judgment to examine how they are applied. Thus the term *ringworm* is applied to

1. Circular patches of porrigo, called *ringworm of the scalp*, (page 135) which differs from herpes both in the nature of the eruption and its situation, being pustular and attacking the hairy scalp.

2. The oval patches of impetigo (p. 130) or *running tetter*, are sometimes called ringworms, particularly the insulated patches, of which such as attack the hands and fingers of certain trades are called *bricklayer's itch* and *grocer's itch*. These patches may be distinguished in whatever situation they occur, even when in their most circumscribed and best defined forms, by their outline approaching more to an irregular oval than to a circle; and by being

clusters, not of vesicles as in the herpetic ringworm, but of pustules.

3. Patches of psoriasis or scaly tetter, (p. 131) and especially when they occur on the back of the hands, and are in this situation denominated *baker's itch*; but the patches of psoriasis are easily distinguished by their wanting the circular form, by the absence of vesicles and presence of scales, the direct reverse of which three particulars occurs in herpetic ringworm.

4. The circular scaly patches of lepra or *leprosy*, (p. 132) which in shape resemble herpetic ringworms, but differ from them both in the absence of vesicles and the presence of scales.

5. Local patches of (a disease which has not been noticed in the preceding pages) *eczema*, an eruption of vesicles crowded together, and at first without being inflamed, and which, when insulated in patches, is also sometimes denominated *grocer's itch*, &c. from its attacking the hands of persons who are employed among sugar, lime, &c. as confectioners, masons, and sugar bakers. Patches of *eczema* may be distinguished from herpetic ringworms by not having so regularly a circular form, by not being preceded or accompanied with fever at their first appearance, and by their not having an inflamed base when recently formed. Its not being contagious, and being in clusters or patches, distinguish *eczema* from the Itch, (*scabies*.) The treatment of *eczema* may be the same as of herpes.

Herpes, being generally in this climate, though a frequent yet a mild complaint, and

seldom of long continuance, it is not probable that many patients affected with it should resort to Askern, except such as experience repeated and renewed attacks of the complaint, or in whom the eruption of vesicles is succeeded by a spreading ulceration,* for the cure of which warm bathing might be tried, also the vapour bath, and frequent ablution of the sores with the mineral water cold, and drinking the water in the usual manner.

* Herpes excedens of various authors, seems to be the Impetigo rodens of Bateman, and Vogel calls a similar cutaneous disease Herpes, Serpigo. I have only witnessed one case of Impetigo rodens, and in that I am not aware that any mineral water had been tried. Dr. Underwood says Herpes excedens is "rather a sore than an eruption."—Diseases of Children, vol. 2, p. 25. Mr. Benjamin Bell includes under this title an ulcer, "easily communicated by contagion, that is by the application of the virus, either through the intervention of clothes, spoons, or other table utensils."—Surgery, vol. 2, p. 410.

FINIS.

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